



Design and Operations Report – St. Clair - Sombra

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Date: December 23 2009

REV 1 – March 1, 2010

REV 2 – April 20, 2010

REV 3 – June 22, 2010

REV 4 – September 8, 2010



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Introduction

The St. Clair - Sombra Solar Farm is proposed on an approximately 140 hectare tract of land located at Smith Line, Town of Sombra, County of Lambton, Province of Ontario, Canada, approximately 2 km east of the St. Clair River. The proposed 20 Megawatt (MW) farm will deliver clean electricity to power homes in the Lambton County area.

The St. Clair - Sombra Solar Farm is proposed to be constructed over 2 tracts of land located to the north and south of Smith Line, to the west of Baseline Road, and totals approximately 140 hectares in area. The tracts are bordered by Bentpath Line on the North, Baseline Road on the West, and other agricultural properties to the south and east. The site abuts residential or agricultural properties on each boundary.

The majority of the existing site is devoted to agriculture with the primary crop being corn. There are existing agricultural buildings on the site. A wood lot extends approximately 160m in from the eastern boundary on the North side of the property, which will remain during and after construction.

The proposed solar farm consists of approximately 61 hectares of solar arrays, mounted on fixed steel supports and arrayed in long rows. Each array will be connected to a small shelter that houses electric current conversion equipment and switches. The electric power from the converter shelters will be run via underground cable to electric utility interconnect equipment at the edge of the arrays, and from that to the electricity distribution line. A 31 meter high antenna tower will provide remote monitoring capability of the solar farm by the electric utility.

The facility will be surrounded by a 2.1 meter high security fence (total height) and will have access at one location from Smith Line through a secured gate.

To be consistent with First Solar's core value of environmental responsibility, the planning and designing of the solar farm has been conducted with a conscious effort to minimize any negative environmental impact. Studies and assessments of the existing animal and plant populations, the terrain and water drainage requirements, and surrounding residences have been undertaken. Terrain modifications and ground disturbances will be kept to the minimum extent practical in order to maintain existing water drainage patterns. Soil erosion and sediment control measures will be employed during construction. There will be no addition of paved surfaces, and only a minimal addition of gravel for site access roads.

At the end of construction, the entire facility except for the internal gravel access roads will be planted with low-maintenance grass which can sustain itself with rainwater. The perimeter of the site will be landscaped to reduce visibility of the solar farm from adjacent roadways and properties where necessary. Because of long term plantings on much of the site, its value of the site as an wildlife habitat will improve. The solar farm will be a passive facility with no emissions to the atmosphere, and minimal light and noise impacts. Any potential noise generated is required to be below Ministry of Environment (MOE) noise limits. After construction is complete, the Project will have only a minimal, if any, requirement for water usage. Once in operation, traffic to the solar farm will be extremely light, with less than one trip per day anticipated.

Site Plan

Site Plan Diagrams

A comprehensive Site Plan Drawing set has been prepared as part of this application. These drawings, sheets REA-01 through REA-13, illustrate the necessary information to evaluate the proposed solar farm. The plans walk through the site location, existing conditions, environmental constraints, proposed site improvements (including layout, grading, drainage, landscaping, and soil erosion control), and all of the intricate details of the system and construction procedures. A full sized set of plans will accompany this application. A reduced set of plans can be found in Appendix A of this report. The following table is the list of drawings being submitted as part of this application:

Table 1 - Proposed Site Drawing Package

Sheet Number	Sheet Description
REA-01	Cover Page
REA-02	General Notes/Legend/Abbreviations
REA-03	Existing Conditions
REA-04	Overall Constraints Map
REA-05	Site Improvement Plan
REA-06	Construction Staging & Lay-down
REA-07	Grading Plan
REA-08	Erosion Control Plan
REA-09	Drainage Improvement Plan
REA-10A	Tree Screens & Field Plantings
REA-10B	Landscaping Sections & Details
REA-11	Typical Table Plan & Details
REA-12	PCS Shelter/PVIS Equipment Details & Sections
REA-13	Construction Details

Significant Project Area Features Investigation & Reports

Prior to beginning the site layout process, several items need to be investigated in order to produce a plan that is properly located to minimize detrimental impacts to the surrounding area. Through investigative research by qualified professionals and their reporting, unfavorable development areas are located and a layout is generated based on the unconstrained land. Land can be labeled constrained due to environmental features (such as watercourse, floodplains, woodlots, etc.), historical features (archeological/heritage assessment), occupancy (threatened /endangered plant or animal, wetlands, and areas of significant scientific interest), or protected lands (such as the Protected Countryside, Lake Simcoe, Oak Ridges, or Niagara Escarpment). The information below, in Table 2, lists of all the prepared investigations and report summaries and their authors. All of the reports will be submitted as part of this application and will be useful when reviewing the REA Improvement Plans.

Table 2: Supporting Report Information

Report Name:	Prepared By:
Acoustical Assessment Report	Golder Associates
Archaeological Assessment	Timmins Martelle
Construction Plan Report	First Solar
Consultation Report	Lakeshore

Decommissioning Plan Report	First Solar
Designs & Operations Report	First Solar
Environmental Impact Study	AMEC
Heritage Assessment	First Solar
Natural Heritage Assessment	AMEC
Project Description Report	Lakeshore
Protected Properties Report	First Solar
Reflection Study	First Solar
Stormwater Management Plan	AMEC
Water Feature Assessment	AMEC

Proposed Solar Farm Project

Project Location

The tract is approximately 2 km East of the St. Clair river, on either side of Smith Line. The project is split zoned, “A1” (by-law 39-2004) and “M2” (by-law 39-2004). It is situated in the North half of Lot 1, Concession 11.

The proposed St. Clair -Sombra design, as depicted on the conceptual plans found in Appendix A, evolved subsequent to completing various investigations with respect to the research and determination of site constraints. These investigations included, but were not limited to, the following:

- Identification and review of local zoning parameters
- Identification and review of applicable County and Provincial Regulations
- Identification of available utility services and any regulatory considerations, potentially limiting their availability.
- Site inventory to identify environmentally constrained land
- Identification and review of relevant roadway/highway access issues and egress constraints

The above effort resulted in the identification of several Project considerations requiring additional study prior to proceeding with a detailed design. Before site planning and layout could commence, natural and water features (as outlined in the Renewable Energy Approval (REA) regulations) had to be identified, investigated, and delineated. Information was also derived from various discussions conducted with the Ministry of Natural Resources, local Conservation Authorities, local municipalities, third party planners, engineers, and other professionals. A field visit was completed to validate the location and extent of the sensitive features. As a result, a layout was generated which, to the greatest extent possible, avoided impacts to mapped features.

The conceptual plan has been designed so as to generally conform with the zoning requirements of the Regulating Authorities, to be non-disruptive with the surrounding area, and to be sensitive to the environmental constraints of the site. Through the design process, the layout of the proposed development went through several revisions in an effort to maintain site compatibility and infrastructure placement. The submitted layout is considered the best fit solution, consistent with the zoning and environmental criteria.

From these various reports the site summary for the proposed solar farm is outlined below.

Cultural and Natural Features & Water Bodies Investigation

As identified in the Natural and Water Feature Assessment Reports an investigation of available data, along with field visits and discussions with the St. Clair Conservation Authority and the Ministry of Natural Resources have identified the following features, shown on Table 3, on the subject property:

Table 3 - Natural Resource Inventory

NATURAL FEATURE	EXISTS IN VICINITY OF SITE?	DISTANCE FROM SITE
Provincially Significant Northern Wetland	NO	N/A
Provincially Significant Southern Wetland	NO	N/A
Provincially Significant Coastal Wetland	NO	N/A
Provincially Significant ANSI (Earth Science)	NO	N/A
Provincially Significant ANSI (Life Science)	NO	NEAREST IS > 4 KM AWAY
Significant Valley Land	NO	N/A
Significant Woodland	WOODLAND A WOODLAND B	ON SITE ON ADJACENT PROJECT (WEST)
Significant Wildlife habitat	NO	N/A
Provincial Park	NO	N/A
Conservation Reserve	NO	N/A
Ave. Annual High Water Mark of a Lake trout Lake at or above development capacity	NO	N/A
High-water mark of a Permanent or Intermittent Stream	NO	N/A
Seepage Area	NO	N/A
Southern Wetland	NO	N/A

NATURAL FEATURE	EXISTS IN VICINITY OF SITE?	DISTANCE FROM SITE
Sand barrens, Savannah, or Tall grass	NO	N/A
Alvar	NO	N/A
Municipal Wetlands	NO	N/A
Endangered Species (Animal)	Colinus virginianus (S1)	ADJACENT TO SITES WEST SIDE
Threatened Species (Animal)	NO	NEAREST IS > 1KM AWAY
Rare Species (Animal)	NO	N/A
Endangered Species (Plant)	NO	N/A
Threatened Species (Plant)	Carex emoryi (S4)	>200 METERS NW OF SITE
Rare Species (Plant)	NO	N/A
Municipal Drain	1. RIVERS LAPISH (DITCH) 2. WATSON TULLOCH 3. MYERS DRAIN	1. NORTH PROP. BOUNDARY 2. WEST PROP. BOUNDARY 3. SOUTH PROP. BOUNDARY
Municipal Natural Environmental Area	1. McKEOUGHGH FLOODWAY	1. 250 METERS SOUTH OF THE SITE

All of the environmentally sensitive areas (in and around the site) defined through the various investigations were mapped on the “Constraints Plan” (REA-04) overlaid on an aerial photograph of the project. The proposed project location boundary or limits of improvements/disturbance were also added along with the surrounding area within 125 and 300 meters. In addition, on the “Existing Conditions Survey” (REA-03), the site topography and existing features were field located to show their exact configuration. This helps to illustrate the impact of the proposed solar farm will have on the subject property and the local area. A detailed EIS report, submitted as part of this application, has been prepared in case a certain feature’s buffer could not be respected, due to the site improvement.

Heritage Resources: As identified in the Heritage Assessment and Protected Properties Report dated November 23, 2009, there are no heritage resources within 125 meters of the property. This includes land subject to an agreement or covenant; cultural value, cultural significance, Heritage Conservation District, or a historic site.

Archeological Resources: There are no archeological resources within 150 meters of the property.

Protected Properties: There are no protected properties within 150 meters of the property. This includes land subject to an agreement or covenant; cultural value, cultural significance, Heritage Conservation District, nor a historic site. The Ontario Ministry of Culture will review and approve First Solar's plan for preservation and protection of these cultural heritage resources as part of the REA

Surrounding Area within 300 meters

Roads: The tract is generally bounded by Bentpath Line on the north, 670m to the South of Smith Line, Baseline Road on the West, and 600m to the East of Baseline Road on the East.

Buildings and Structures: A limited number of residential and agricultural buildings or structures exist within 300 meters of the site. These will not be impacted by the construction or operation of the solar farm.

Utility Corridors: The 27.6kV Lambton Township Transmission Line runs North-South along the western boundary of the property. Connection points for the two 10MW blocks of solar arrays will be adjacent to this transmission line.

Right of Way/Easements: Smith Line runs East-West through the middle of the property. Bentpath Line runs East-West along the North boundary of the property. Baseline Road runs North-South along the western boundary of the property. Each road has a standard right-of-way (ROW) and easement associated with it.

General Facilities Components and Features

There are no significant hazards involved in either the construction or operation of the solar farm. No hazardous materials are used in the construction of the facility. The materials that comprise the solar panels are inert in their manufactured state. The transformers used on all of First Solar's projects, including the St. Clair Sombra solar farm, utilize biodegradable oil. Construction activities include the driving of posts into the ground onto which the modules are clipped into place. Trenches are excavated to allow for cable burial and drainage, but all trenches will be backfilled each day. Concrete support pads and piers are installed under larger electrical components to ensure stability.

The solar farm will include twenty, one-megawatt arrays of solar modules, converting sunlight first to direct current (DC) power, then to alternating current (AC) power, as used in your home, by using solid state inverters. Electricity generated then passes through switchgear and is connected to the existing distribution line adjacent to the property. Other than the shelters housing the inverters, no buildings are proposed on the site. Existing buildings will be demolished to make way for a safe Project site. In addition to the structural and electrical components of the solar farm, a small network of interior roads, made of gravel or recycled concrete, will allow for better maintenance access.

Construction staging will occur off of Bentpath Line, with an entrance just east of the proposed arrays. Minimal grading is proposed to allow for adequate drainage of stormwater within the solar farm. The Erosion and Sediment Control plan will protect the site and the surrounding waterways. This will primarily be accomplished during construction by use of structural erosion

and sediment control practices such as silt fencing and mud mats, as approved by the St. Clair Region Conservation Authority. After construction, the site will have been converted from bare agricultural land to grass covered fields with graveled access roads where needed. Neither the grassed areas nor the gravel will contribute sediment, fertilizer or pesticides to site runoff whereas the present agricultural use does exhibit these impacts.

Landscaping will be added to provide a visual buffer from the site. A site perimeter fence will be installed as required by the Electrical Safety Authority and for general security. All visitors to the Project are required to obtain approval to visit the site from the Construction Manager and/or Operations and Maintenance Manager prior to arrival at the Project. Visitors go through an extensive site safety briefing and are required to wear appropriate personal protective equipment. Neither photography nor cell phone use is allowed on site.

Photovoltaic (PV) Arrays

In Appendix A, the conceptual Site Plans illustrate in plan, detail, and section views the various components of the proposed project. The proposed Site Layout can be found on REA-05 “Site Improvement Plan” and shows the locations of the construction entrances, staging and lay-down areas, array, PCS/PVIS shelter, transformers, roadways, and fencing. The equipment details and sections can be found on REA-11 through REA-13. A more detailed description is provided below about the various components of the proposed solar panel system.

Typical 1MW Array

A typical array of solar modules produces 1 megawatt (MW, or 1,000,000 Watts) of power. The modules are mounted on I-beam-like posts, allowing for a fixed orientation toward the southern sky. Each module is electrically connected through buried cables, collectively providing DC power to the inverters inside the power conversion station (PCS) shelters. The inverters convert the DC power to AC power, which gets routed to the adjacent power lines via switchgear. The switchgear, which synchronizes the AC power made onsite with the power already running in the power lines, will be remotely monitored by the local utility.

The St. Clair – Sombra Solar Farm Project involves the installation of 20 arrays of photovoltaic (PV) modules or panels, manufactured by First Solar, with the cumulative capacity to generate 20 MW_{AC} of power under peak solar conditions. Each 1 MW_{AC} PV array will consist of approximately 16,860 PV modules and one Power Conversion Station (PCS), which includes two 500 kilowatt (kW) inverters and one 1,000 kilovolt amp (kVA) isolation transformer. Each 1 MW_{AC} array covers approximately 2.7 hectares. The quantities listed are subject to change based on the time the project is designed and approved.

Principal materials included in the PV arrays include glass, steel, and various semiconductor metals. At the end of their useful life, most of the Project materials will be recycled, including the PV modules themselves (which will be collected through First Solar’s pre-funded module collection and recycling program), the steel tables and posts, and the wiring.

Sewerage Generation

The farm house on the site had a septic system. No other sewerage works are present. The septic system will be abandoned in place and decommissioned.

No permanent sanitary sewer facilities are necessary for the St. Clair – Sombra 20 MW photovoltaic farm. During construction of this site, mobile toilet and washroom facilities will be

provided for the construction crews. One toilet stall will be provided for every 10 workers on site by means of restroom trailers. These trailers will include toilet stalls and sinks for hand washing. The wastewater from these units will be stored in tanks within the trailers and will be serviced (pumped out) by the sanitary rental company on a weekly basis or more frequently as needed. Wastewater will be disposed of off-site by the sanitary rental company.

Restroom facilities shall be inspected on a daily basis to ensure they are functioning correctly and are cleaned of debris and sanitary. If during the inspection the restrooms are found to be non functional (leaking, not flushing properly or in need of tank pumping services, etc.) the sanitary rental company will be contacted immediately to service the units.

The mobile restroom facility trailers will be used for the duration of construction activity and remain onsite until the site's completion at which time they will be removed by the sanitary rental company.

Water Source & Usage

The annual demand for water supply for the operation of the Project is expected to be minimal, if any. The Project uses no water for electricity generation or cooling. Rain water and snow are generally sufficient for cleaning modules.

The only water required for construction relates to the temporary trailers and occasional dust control spraying. Water trucks will be utilized for these purposes. Following construction, the solar farm will not consume water. The duration of construction, and therefore of water usage, is anticipated to be less than twelve months. The Project is expected to use a maximum of 100,000 liters per day (lpd) during very dry, dusty days. During normal rainfall, water usage will be minimal (approximately 500 liters per day). Water use during construction of the solar farm will not interfere with others' use of water in the surrounding area.

Noise & Odour Receptors

For the purposes of determining potential noise/odour impacts on the surrounding environment, "noise receptors" are defined as residential locations near the Project site. Noise receptors are identified in the Acoustic Assessment report (attached) prepared by Golder Associates, in accordance with Ministry of Environment standards. The overall conclusion is that the project does not exceed the Ministry of Environment's noise level limits. The report indicates that the Project will conform to requirements for noise levels less than 40 decibels at the point of reception. This noise level is literally "as quiet as a library". This mainly applies to the electrical equipment (invertors and transformers) which could produce noise. For further details, please refer to the accompanying "Acoustical Assessment Report".

Facility Design Plan

Solar energy provides a sustainable, renewable, and clean source of energy. It conserves natural resources by considerably reducing fossil fuel dependence, green house gas emissions, and peak time grid constraints. Utilizing solar energy provides a blue-print for meeting the long term energy requirements of global society.

The proposed solar farm will utilize several components assembled in series to convert sunlight into end-user energy. The mechanisms have been designed to maximize output while avoiding negative impacts to the surrounding area. The following sections to follow, will address the

details of the system and how the components work together to generate clean energy.

System Components

Array Area

The array area will be installed over previously farmed lands. In order to prepare the array field, the ground will be mowed/harvested, cleared, and grubbed. In areas that are subject to land leveling and grading, the top soil must be stripped and stockpiled. After land preparation activities are completed, the arrays can begin to be assembled. After construction, the grounds will be re-vegetated and become established. Long-term impacts will be negligible (the 0.02 sq. inch footprint per post and the gravel access roads) on the ground as vegetation will aid in the local wildlife population returning to the area.

Panels, Tables, and Support Devices

The system will use First Solar's "thin film" photovoltaic solar panels. A copy of the module specification sheet can be found in Appendix B for more information. The panels employ the stable compound cadmium telluride (CdTe) as the semiconductor material. The semi-conductor is placed between glass panels and secured together. The panels are fastened together on tables in rows to work in series.

PV arrays consist of groups of PV modules called "tables". Each table consists of up to 16 modules and measures approximately 2.4 meters wide by 2.4 meters long. Tables will be mounted on an angle with respect to horizontal, to steel racking supported by vertical steel columns, spaced at approximately 3 meters center-to-center, and driven into the ground to an approximate depth of 1.1 meter below grade. Once mounted, the front of each table will reside approximately 600 mm above grade, while the rear will be no more than 2 meters above grade.

The first step in mounting the solar modules is to drive W-shape steel posts into the ground using a pneumatic pile driver. Once the posts are installed, laborers hand-install the rest of the structural system. Bent sheet metal brackets are attached to the flanges of the posts, usually with three 5/8-inch bolts. A preassembled table composed of two beams (running parallel to the row of solar modules) and eight or ten module rails (running perpendicular to the row of solar modules) is then placed on the sheet-metal brackets and attached with four 3/8-inch bolts. Module clips and solar modules are then installed simultaneously to the module rails. Each clip is attached using a 1/4-inch bolt. There are generally 40 module clips per preassembled table.

Shelters & Electrical System

The PV modules will be electrically connected by wire harnesses and combiner boxes that feed the array's PCS via underground direct current (DC) cables. Each PCS will contain two 500 kilowatt (kWac) inverters located within a climate controlled inverter enclosure and one 1,000 kilovolt amp (kVA) transformer. The PV inverters convert the DC electric input into grid-quality AC electric output. The electrical energy produced in the PVIS is connected to the grid via overhead (aboveground) wiring. Details regarding the trenching for below-ground wiring can be found on REA-13 found in appendices of this report. A copy of the equipment specification sheet can be found in Appendix B.

Access Roadways, Security, & Fencing

In/egress entrances will be made of gravel/rock and tie into the existing roadway with a smooth

rounded radius. Vehicles will enter the site and be directed towards the construction trailer and parking area. Before access into the construction yard is gained, vehicles must stop at the security booth to be logged in. The guard will open the security gate to allow access/egress into the site. The entire site will have security chain link fencing around the perimeter.

The arrays will be separated by access corridors, some containing gravel, about 6-7 meters wide, dividing each array into quadrants. The roadways are designed to accommodate vehicles for the deliveries of the heavy equipment (approximately 60 tons). The roadways will need to be periodically inspected and maintained throughout the life of the project. Additionally, the perimeter access roads have been designed with 20 meter (outside radius) to allow for larger vehicles/trucks to traverse the site.

Combiner Boxes

Each array is electrically isolated from the rest. The solar modules are tied together in series to make a maximum system voltage, and strung in parallel to combine currents. Harnesses are used to combine currents into circuits no larger than 30 amps for connector rated reasons, however circuits are then combined using 'Combiner Boxes' (junction boxes) in another parallel configuration.

These junction boxes can be rated anywhere between 200 and 400 amps. The combiner box has a DIN rail mounted series of fuses to protect the positive harness circuits. The other side of the fuses is tied together using a Bus Bar. The fuses are then in parallel, and the currents combine to a range between 200 and 400 amps, short circuit.

All the combiner box outputs meet at the PCS shelter to be terminated at an over-current protection device, before meeting the input of the inverter. The combiner boxes are strategically placed in the 1MW array in order to compensate voltage drop from cable resistance, as well as system ampacity from parallel combined circuits. All combiner boxes have a DC disconnect switch for monitoring and maintenance safety purposes. For more information and sketches of the combiner boxes, refer to Appendix B. This same design was utilized for the Sarnia 60 project and the sample drawings provided.

Transformers

Each one-megawatt array has one 1,000 kVA transformer. It is housed in the PCS shelter with the inverters. The transformer uses electromagnetic induction to transform the power that the solar panels produce from 208 volts to 27.6 kilovolts, which is the voltage of the power in the local distribution grid. This site proposes to use a three-phase VFI transformer (the equipment specification sheet can be found in Appendix B). Simply put, this will allow for voltage transformation and over-current protection in one piece of machinery. Transformers contain metal, electrical, and paper components.

Bio-degradable Oils

Large transformers, like the ones proposed on the solar farm, use oil to cool the transformer and to protect their metal components. Traditionally, transformers have used mineral oil for this purpose, but oils derived from food-grade vegetable and seed oils have recently become available for this use. All of First Solar's transformers use these plant-based oils, which are biodegradable in both soil and aquatic environments. These oils are recyclable at the end of their useful life and are also non-toxic, even to recently-hatched fish. A final benefit of the plant-

based oils is that they are much less flammable than the mineral oil that is used in many other transformers, with a flash point of 330 degrees centigrade. The material is 99% bio-degradable within 24 hours. Product literature can be found in Appendix B of this report.

Switchgear

There will be two PV Combining Switchgear (PVCS) house for this project. The PVCS house is approximately 3.6 meters high and is elevated 500 mm above grade. The PCVS house will be located near the connection point to the local grid. A 27.6 kV high-capacity collection system line will then connect the power output from the PVCS to the Project Substation. The on-site electrical collection system is designed to minimize electrical losses within the Project Site prior to delivery to the Project Substation.

Foundations

The foundations of all structures on site are either pre-cast, cast-in-place reinforced concrete, or steel post, dependent upon soil conditions. Transformer pads are precast concrete, roughly 12 feet by 14 feet and 1.5 feet deep. Inverter shelter foundations are precast concrete, roughly 12 feet by 21 feet, with a depth of 3.5 feet. Switchgear pads are composed of a cast-in-place slab, generally 15 feet by 33 feet and 1.5 feet deep. Interior to the cast-in-place slab of the switchgear pad is a precast vault measuring roughly 9 feet by 11 feet, with a depth of 8.5 feet. All concrete foundation structures are to rest on a drainage layer of 6 inches of 3/4-inch stone. The support structure of the solar modules is composed of wide flange steel posts with a sub-surface depth of generally 4-8 feet based on soil conditions.

Drainage Improvements

General Practices –

The Project will be designed such that the volume and quality of storm water runoff are maintained, if not improved, from the existing condition. This will be based on detailed hydrologic and topographic studies that will be performed in conjunction with the permitting process. Due to the limited increase in impervious areas, it is not expected that the PV arrays within the Project Site will affect site runoff.

The proposed Project is not expected to alter the site's pre-development hydrologic conditions. The Project has been designed to contain the following low environmental impact features:

- Hard-scape and impermeable surfaces are minimal;
- PV modules are elevated above grade, which preserves permeability of the Project Site;
- Existing natural drainage flows have been maintained. Existing and proposed drainage patterns and land contours are shown on the accompanying REA Permitting Plan Set. To the greatest extent possible, local drainage divides and flow patterns will be maintained
- Vegetated waterways provide filtration and increased percolation for storm-water runoff.

Site Specific Measures-

In its present state, the site generally drains from east to west, with runoff entering either the drain along Baseline Road. In the proposed condition, the existing drainage pattern will be

maintained, with overland drainage flowing from east to west. Most of the overland flow will be picked up by the proposed French drain system, which empties into the drain along Baseline Road, exactly the same as in the existing condition.

On the St. Clair – Sombra site, a minimal network of French drains will be utilized to aid surface drainage. The proposed French drain system will be similar to the tile systems used in many of the surrounding agricultural fields. The main difference between a French drain and a tile drain is that the French drain is buried in a small trench of clean stone, where the tile drain is buried directly in the site soils. French drains were chosen for this site to allow surface runoff to reach the drain pipe more easily, keeping the working surface drier during a wider variety of weather conditions. The overall direction of water flows on the site is not altered by these drains. The French drain system will temporarily decrease the amount of time it takes for water to drain from the site, marginally increasing the flow. However, the change in ground cover from the existing plowed, mostly bare soil to a grass field will ultimately decrease the flow and increase the quality of the runoff from the site. A complete hydrological assessment and stormwater management plan are provided as part of this application and have been completed by AMEC Engineering.

Facility Operations Plan

Daily Facility Functions

The individual pieces previously mentioned above are engineered together to form a photovoltaic system capable of producing clean energy for local citizens. First Solar proposes to employ the use of solar photovoltaic technology to produce electricity. Solar photovoltaic's, (PV), use the energy from sunlight to generate direct current through the semi-conducting effect. PV modules are installed on a fixed mounting system angled toward the sun.

In the presence of sunlight, direct current is generated by each PV module on the order of 50 volts DC and slightly under 2 amperes. Modules are connected in series strings similar to batteries to sum the voltages of each module. Each string produces between 330 and 600 volts DC and up to 1.75 amperes during operation.

These module strings are connected in parallel in order to sum the currents. Listed and approved cable assemblies and fused combining boxes are utilized to safely transport the electrical energy to a state of the art static power conditioning inverter. The inverter converts the direct current (DC) to alternating current (AC) through the use of ultra high efficient insulated gate bipolar transistor (IGBT) technology. Today's inverters operate nearly at 98% efficiency.

The inverters are reliable, safe and very quiet operating devices. The only moving parts are internal cooling fans. The inverters are housed inside an aesthetically pleasing shelter to allow for safe and easy maintenance while providing protection from the elements.

The AC output is immediately raised by a transformer to match with the connection voltage requirements of the local electrical utility. The transformers are located within the field of PV modules far from the public eye. They are of the pad mounted design, completely enclosed with no live parts to threaten life or property. This design is the same as that which is used by electric utility companies all over Ontario when sited in public areas.

While the PV modules and inverters are the heart and lungs of the solar farm, there are a few other components needed to complete the design.

There is the need for electrical switchgear to protect and control the connection to the electric utility. This equipment must meet the requirements of the utility and the ESA for safety and operation. This equipment is all metal enclosed with no exposed live parts.

Finally, collocated with the switchgear is a small shelter to house the protection, control, and data acquisition/communication equipment.

There will be approximately two permanent employees of the facility. Employees will monitor and report the performance of the Project, conduct preventive and corrective maintenance, receive students and other visitors, and maintain the security.

While the project will largely be self-sufficient upon completion of construction, periodic operations and maintenance (O&M) activities will be required. Key elements of the O&M plan include management of lighting, reflectivity, noise, facility replacement materials storage, safety, and repair. A copy of the "Module Users Guide" can be found in Appendix C.

The PV arrays are designed to withstand code prescribed seismic activity and wind forces. Any realignment of the modules and structures will be handled on an as needed operational basis.

Project Operations and Maintenance

Electrical Maintenance and Fire Safety

The project is not located adjacent to either urbanized areas or wild-lands. There is no reasonably foreseen risk of the Project being the source of a fire, nor will it contribute to spreading an existing fire. As with all electrical installations, there is some electrical fault risk. However, this risk is mitigated during installation as a careful engineering review of all electrical components has been completed in accordance with all relevant requirements. Once operating, the facility is subject to a long-term operations and maintenance agreement. It will be regularly monitored to ensure proper power output. Regular on-site inspections and maintenance will also be performed and will ensure proper vegetation management. As the construction of the project is primarily glass, concrete, and steel, the facility is not flammable.

Traffic

The facility will employ a permanent workforce of approximately two people. Only limited deliveries will be necessary for replacement PV modules and equipment during operation. Peak traffic during long term operations will be approximately two vehicles and two trucks (if deliveries are required) per day. A traffic report has been prepared and is being submitted as part of this application.

Lighting

For security and maintenance purposes, shielded, task-specific lights will be installed at the construction offices, the construction staging areas, and possibly on or near each PCS station. These lights will be turned on either by a local switch, or by motion sensors that will be triggered by movement at a human's height during maintenance or emergency activities. No lights are currently planned around the Project perimeter to minimize the Project's visual impact on surrounding development and roads. All exterior lights will be shielded to minimize their impact to the night sky and neighbors. Seldom, light bulbs will need to be replaced should they become inoperable.

Water

The annual demand for water supply for the operation of the facility is expected to be negligible. The Project uses no water for electricity generation or cooling. Water is not required for PV module washing; rain water and snow are sufficient for cleaning modules.

First Solar does not plan to drill any new water wells on site and will use a trucked in water supply during construction. This will be used for dust control purposes, as needed, from an off-site source.

Reflectivity

The PV modules used in the installation absorb over 90 percent of the light received; as a result, glare from reflected sunlight is not expected to be a concern. PV panels have been installed at numerous airports in the United States, including Denver International Airport and Nellis Air Force Base, and studies found that the reflections from PV installations would not cause problems for airplanes in the vicinity.

A Reflectivity Study prepared by First Solar examines potential reflections from PV modules at various key observation points. The study will be submitted as part of the visual analysis.

Operational Noise

The project will employ passive solar power generation through the use of fix-mounted PV solar modules. These PV modules do not require heat transfer fluids or mechanical equipment, and do not generate noise like other solar energy facilities can. Each 1 MW PV array occupies approximately 2.7 hectares, and is equipped with a Power Conversion Station (PCS), which includes two inverters and one transformer. The PCS serves to convert DC to AC at each 1 MW_{AC} array. The only noise sources associated will be from the PCS.

A detailed noise analysis has been prepared as part of the permit process and the project will meet all applicable local noise standards. A noise contour analysis of a solar farm in Sarnia using similar equipment indicated that the applicable local noise standards were met, even though noise receptors (residences) were more numerous and located closer to the solar farm than at this project. The project will not exceed the Ministry of Environment's noise level limits. For further details, please refer to the "Acoustical Assessment Report".

Power/Communication

The facility will consume a very small amount of power for security lighting during the nighttime while the facility is not in operation and for PCS shelter HVAC. This power will be supplied from the existing electrical distribution system in the area. The project will not require any additional power sources for standby or emergency power supply.

For transmission of operational data and to support any employees working on site, existing wired or wireless telecommunications facilities. In the event that these facilities are not available in the vicinity, the project will supplement with small aperture (less than one meter) satellite communication gear.

Vegetation Management & Maintenance

First Solar is currently undertaking testing at sites in the vicinity to evaluate vegetation types which can support the relevant local wildlife populations, and not interfere with ongoing

operations.

Shading under the modules may reduce evapo-transpiration of local plants and allow vegetation to grow taller than vegetation exposed to direct sunshine throughout the day. There will be a vegetation management plan implemented to control the height of vegetation and to control any invasive exotics. This plan will be established based on the First Solar's findings at the vegetation test site.

Depending on the native and planted vegetation growth rates, occasional grass cutting may be required to avoid the panels being shaded. Maintenance will maintain the grass height at about 460 mm.

Environmental Effects Monitoring Plan

Identification of Natural Feature Impacts

Review of the Project's Layout drawings and Site Plans indicates that disturbance via construction activity within the environmentally sensitive areas, listed in Table 3, has been minimized through due diligence planning and design efforts. However, certain project activities must occur within and adjacent to some of the environmentally sensitive areas. Specifically, the following is noted:

- Significant Woodlot – Woodlot A is located in the north-eastern portion of the site and on the adjacent parcel (east). The woodlot will remain untouched throughout construction. Woodland B is located on an adjacent parcel to the west and will also be unaffected by our construction. Both Woodlands will be protected during construction so that they remain undamaged in their current state.
- A municipally identified Natural environmental area was located in the immediate area. The W. Darcy McKeough Floodway is located approximately 250 meters south of the site. There will no short or long term impacts to either area.
- An endangered animal species, *Colinus virginianus* (S1) was located adjacent to the western side of the properties. The adjacent parcels are separated from our site by Baseline Road. The woodlots on both properties to the west contain a substantial amount of vegetation suitable for the bird's habitat. Since the woodlots are not immediately adjacent to the site. It is not believed that the development will not disrupt their activities. Additionally, as part of the environmental monitoring plan, should the species be found on site, construction will cease until the animal can be safely relocated.
- A threatened plant species, *Carex emoryi* (S4) was identified greater than 200 meters northwest of the site. This plant will be unaffected by the proposed project.
- Several municipal drains are located along the property boundaries. A minimum 20 meter buffer to the array will be respected to the drain being used. However, many of the buffers are larger. Historical drainage patterns will be maintained. Water quality will be improved by converting the farm land into a grassed area. This will decrease pollutant and sediment to the receiving drain.

Potential Negative Impacts, Performance Objectives and Mitigation Strategy

Potential negative environmental impacts during construction and operation have been considered in the design of the proposed solar farm. Potential negative impacts, desired performance objectives, and mitigation strategies are outlined below.

1. **POTENTIAL NEGATIVE IMPACT:** Construction will require the removal of existing vegetation from a portion of the site. The loss of existing vegetative cover, temporarily during construction, can lead to soil erosion and sediment control problems if not properly designed for and actively managed.

PERFORMANCE OBJECTIVE: no significant change in stormwater quality and quantity occurs as a result of the proposed project.

MITIGATION STRATEGY: Existing topography will be maintained to the greatest extent possible to minimize the amount of grading required, limit soil disturbance and maintain existing drainage patterns. The greatest potential for adverse impact on stormwater quality and quantity will be during construction. A Soil Erosion and Sediment Control Plan has been prepared to address this potential impact and achieve the desired performance objective. Soil erosion and sediment control measures will be kept in place until construction is complete and/or the disturbed area is stabilized and a crushed stone-tracking pad will be installed at the site access to reduce tracking of sediment onto adjacent roadways during construction activities. For more details see the Soil Erosion and Sediment Control Plan in the Construction Plan Report.

Long-term, as outlined on REA-10 (Landscape Plan), short grass is proposed to be planted under, around and between the arrays. The proposed plantings and landscaping will prevent erosion by stabilizing the top soil and the plantings will act as a vegetated buffer strip and filtering pollutants. Additionally, farming activities which introduce chemicals and pesticides into the land will cease. In addition, separate stormwater management plan has been prepared which demonstrates no adverse off-site stormwater impacts resulting from the proposed solar farm development.

2. **POTENTIAL NEGATIVE IMPACT:** Introduction of construction machinery and activities which will increase the noise in the immediate area during construction and noise from inverters and transformers may impact nearby receptors.

PERFORMANCE OBJECTIVE: During operation, noise at each point of reception in proximity to the solar farm will be not exceed the Ministry noise level limit of 40 dBA. Construction noise will comply with local noise by-laws, as required.

MITIGATION STRATEGY: As outlined in the Acoustic Assessment Report the solar farm has been designed such that noise will not exceed 40 dBA at any point of reception in proximity to the solar farm. Construction hours will be limited to 7am to 5 pm (Monday through Friday), and as required on weekends and in compliance with local noise by-laws. In addition, noise abatement devices will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.

3. **POTENTIAL NEGATIVE IMPACT:** Potential negative impact on wildlife habitat.

PERFORMANCE OBJECTIVE: minimize negative impacts on wildlife habitat and create additional wildlife habitat on-site.

MITIGATION STRATEGY: The project location is presently farmed using relatively invasive traditional agricultural techniques (application of pesticides, tilling, harvesting plants each season). The existing woodlot will be preserved and is proposed to be expanded. Short grass will be planted under, around and between the arrays which will improve the wildlife habitat on-site. For further details see REA-10 (Landscape Plan). Wildlife present on and around the project location and the potential for impact on the same has been assessed in the (insert name of new Environmental Report). All required mitigation measures as outlined in the (Insert name of new Environmental Report) will be implemented to achieve the performance objective.

4. **POTENTIAL NEGATIVE IMPACT:** The potential for fuel spills and increased air emissions is increased with the addition of the construction machinery on site.

PERFORMANCE OBJECTIVE: Limit unnecessary air emissions and achieve no fuel spills during construction while machinery is on site.

MITIGATION STRATEGY: All fueling activities will occur in a designated “refueling area” inside the proposed construction staging and lay-down area, and away from environmentally sensitive areas. Only authorized and properly trained staff will be able to fuel construction vehicles. For further details see the Construction Plan Report. Where an adverse effect may occur as a result of a spill, the Ontario Ministry of Environment (MOE) Spills Action Center will be notified at 1-800-268-6060.

During construction disposal of waste by open burning will not be permitted to limit unnecessary air emissions. In addition, exhaust systems and emission control devices on all construction machinery will be maintained in good operating condition. Noise abatement devices will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.

Environmental Monitoring Program

The overall objective of the project should be positive and beneficial. With environmentally-aware management and sensitive contractor implementation, all environmental risks can be avoided or significantly minimized. Maximum resource benefits will be achieved through the completion of environmental restoration and enhancement efforts. The Project as developed will also benefit the community through efforts to restore and enhance the environment

Throughout the construction period, regular site inspections will be made to monitor the effectiveness of environmental protection measures, as well as to check that no previously unforeseen impacts are occurring. In the event of the latter, recommendations will be made for additional environmental protection measures to be adopted. The frequency of site inspections will vary depending on the nature of works being carried out at any one time. Attention will be concentrated on those operations and locations where the most potentially damaging impacts can be anticipated.

There will be an individual responsible for environmental monitoring (Environmental Monitor). It is their duty to monitor all construction practices involving the any of the following areas:

- Erosion Control
- Noise and Vibration
- Waste Management/minimization
- Contaminated Materials and Wastes
- Emergency Response Procedures
- Air Quality
- Water Quality
- Litter
- Storage of Chemicals and Fuels
- Cleanliness of the road from site traffic;
- Hours of work in the vicinity of residential dwellings;
- Movement and generation of surface water;
- Pedestrian and vehicle diversion and safety;
- Siltation and blockage of drains and water courses

The frequency of inspection will be highest at the initiation of works at the site so that any problems can be recognized at an early stage and remedial works or procedures can be implemented before irreparable damage has occurred. Particular attention will be paid to checking that no undue erosion and sedimentation problems are occurring and that all temporary measures, such as silt traps, are functioning efficiently.

The Environmental Monitor will ensure contractor compliance with the Environmental Management Plan (EMP) as well as all local, provincial, and federal permits. The following responsibilities are assigned to the Environmental Monitor:

1. Surveillance of all construction activities to ensure that all work is completed in compliance with the site's EMP and satisfies requirements of all local, provincial, and federal regulatory requirements and permit approvals.
2. Insure that temporary and permanent sedimentation and erosion controls are installed and maintained in accordance with the Soil Erosion and Sediment Control Plan and the site's EMP.
3. Ensure that all construction personnel and equipment stay within the designated construction area and use only approved access roads.
4. Ensure that fuel handling and equipment maintenance operations are executed away from water bodies and drainage ways. Also, make sure that the contractor maintains the required spill response material as mandated by the EMP and the projects spill control plan.
5. Be familiar with previously identified sensitive areas where unique construction techniques will be required. Make certain that work in these areas is performed as per the specifications approved for these areas and in accordance with applicable I local,

provincial, and federal regulatory requirements and permit conditions.

6. Ensure that all environmental mitigation and restoration plans (i.e. drainage crossings, seeding, erosion control, etc.) are properly implemented in accordance with specifications and in accordance with applicable local, provincial and federal regulatory requirements and permit conditions.
7. Train construction management and crew on various aspects of the environmental compliance program, including the EMP, and expectations.

The Environmental Monitor will need to also complete incident investigations, restoration projects, document preparation, and record- keeping. The Environmental Monitor will conduct routine environmental monitoring audits throughout the construction period to ensure that the EMP policy is implemented and adhered to. Where noncompliance with the EMP or local, provincial, and federal regulatory requirements and permit conditions occurs, corrective measures will be formulated and implemented accordingly.

Environmental Contingency Plan

Environmental contingency planning is necessary to prevent a delayed or ineffective response to unexpected events or conditions that may occur during construction. An essential element of contingency planning is the preparation of emergency procedures that can be put into place should an unexpected incident occur. The absence of contingency plans could result in short or long term environmental effects and possibly threaten public safety. Unexpected events requiring contingency planning that may occur during construction include: extreme climatic events, changes to the construction schedule and human error.

Although these problems are not anticipated to occur during construction, the construction management team and the Environmental Monitor will be prepared to take appropriate action quickly. The Environmental Monitor will identify situations where contingency plans should be implemented. All contractors will be trained to know when to immediately cease operations (e.g., in the case of silt fence collapse) until a repair can be made. All staff will be made aware of and know how to implement emergency procedures. Common materials that will be kept on-site to help respond to environmental emergencies shall include:

- Extra soil erosion & sediment control devices such as fiber rolls, silt fencing, etc.
- Hand tools such as shovels, picks, brooms, and rakes
- Absorbent materials such as quick-dry or sand to help aid in controlling spills.
- Disposal containers/specialty bags to temporarily transport material
- Any other materials as required by the Environmental Monitor.

Emergency Response Plan

All site personnel and visitors are trained in order to familiarize themselves with the locations of emergency assembly areas (trailers) and the pre-determined evacuation routes, the location of fire extinguishers, emergency notification numbers and alarm stations within their work areas.

Although no hazardous materials are stored or used on site, Chemical Valley Emergency

Coordinating Organization (CVECO) policies will be followed by all site employees and visitors in case of an emergency in the surrounding area. Logistic Plans detail that equipment and work supplies are not located in the path of evacuation routes, fire extinguishers, alarm stations, or emergency exits. Per Occupation Health & Safety Act (OH&SA) Regulation 1101, if required based employee count, a Registered Nurse will be present at the site during construction activities.

First Solar prepares a Health & Safety Plan (HASP) which outlines every position and their goal to insure the well being of the site and personnel. It identifies and outlines guidelines to investigate, identify, and rectify safety issues on site. It also contains a full emergency plan for all employees and contractors. It contains evacuation maps, inspection checklists, and processes. A full copy of the report resides in each construction trailer.

Site communication is maintained between all sub-contractors and Environmental Health and Safety (EH&S) staff through site radio. This is shared through “push to talk” phones. In the event of an emergency, an alarm is sounded on site. The Site Safety Manager and security are notified and emergency services are alerted (via 9-1-1). The site evacuation notification system will consist of cell phones and radios. Upon exiting the work area all personnel shall proceed directly to the First Solar construction office trailers to be accounted for.

If an incident should occur, a complete investigation and root cause analysis shall be conducted. Upon conclusion of the investigation, information will be shared with all contractors and employees. Depending upon the severity of the incident, the Ministry of Labor might need to be notified. The Construction Manager will be in charge of the notification to the Ministry.

In case of a spill, the Site Manager, Safety Manager, or designated Environmental Monitor will notify the Ministry’s Spills Action Center at 1-800-268-6060. A record of the incident will be logged into the Environmental Monitoring Report and the communications log and kept on file in the construction administrative trailer.

Emergency Communication

During construction, the Site Manager is the point of contact relating to emergency issues. Following construction, the Operations and Maintenance supervisor is the primary point of contact on emergency issues. As the project is preparing to mobilize, a “Site EHS Manual” is prepared which outlines the commissioning, operations, and maintenance practices and procedures. It has procedures outlined. It also contains a table with emergency contact information. A sample of this EHS manual has been provided in Appendix D, which was utilized for First Solar’s Sarnia 80 project. A customized EHS manual will be created for this site, as the staffing and contractors are finalized.

Non-Emergency Communication

During construction, an electronic bulletin board will be maintained outside the main construction. This board can contain up to 32 messages. It will provide the latest construction updates including the amount of hours and days worked, recordable’s rate, energized area reports, and relevant updates.

Should a significant change in the project, or interruption/disruption of local services need to occur, a notice will be added to the electronic bulletin board. In addition, if deemed appropriate, a notice can be placed in the local newspaper to alert the general public of the

update.

Any communications received via email, fax, or mail, will be logged into the project's Correspondence Log by the document controller assigned to the construction trailer. A formal response will be issued to the correspondent. The correspondence log is maintained electronically, and updates published to the log as the comments are received. The log will reside with the document controller at all times. Should a concern be raised via phone call/message, it will be recorded into a word document, logged in, and responded to in a timely fashion.

Depending upon the nature of the concern, the appropriate regulating authorities (ie – Ministry, Municipality, Conservation Authority, etc.) will be copied on the return correspondence.

The Correspondence Log will record the name, address, and telephone number of the concerned party. It will be time and date stamped as it is logged in. The response will detail the complaint and any actions that are taken to mitigate/alleviate the concerns. Additionally, an outline of how this problem can be avoided in the future.

Consideration for Projects Subject to Land Use Plans

Niagara Escarpment Impacts

The Niagara Escarpment Plan was established to protect the natural environment of the Niagara Escarpment and the land in its vicinity. Only those land uses or developments which are compatible with the protection of the Niagara Escarpment environment should be permitted within the Niagara Escarpment Plan Area. According to the Niagara Escarpment Plan, 2005, approved and ordered 2005 June 1st (OC# 9121/2005) the proposed St. Clair – Sombra Solar Farm is approximately 205 kilometers from the south western bed (along the western shores of Lake Ontario). Therefore, the project will have no impact on the Niagara Escarpment Plan.

Lake Simcoe Impacts

The Lake Simcoe Protection Plan is a vital initiative for the protection of the lake and its future as a source of economic and recreational activity for the surrounding communities. The proposed solar farm is located approximately 255 kilometers to the south-eastern edge of the Lake Simcoe Protection Act Watershed Boundary as depicted on the mapping provided in the Lake Simcoe Protection Act of 2008. The St. Clair – Sombra project will have no impact on Lake Simcoe.

Oak Ridges Moraine Impacts

The Oak Ridges Moraine Conservation Plan is an ecologically based plan established by the Ontario government to provide land use and resource management direction for the 190,000 hectares of land and water within the Moraine. According to the *Oak Ridges Moraine Area Land Use Designation Map* (Ontario Regulation 140/02), the proposed solar farm at St. Clair - Sombra is about 200 kilometers to the western edge of the protected area. The Project will have no impact on the Oak Ridges Moraine Conservation Area.

Green Belt Protected Countryside Impacts

The Protected Countryside 'systems' is comprised of features identified in local, regional and county official plans. For instance, natural heritage and water resource systems are necessary to maintain biological and geological diversity, natural functions, and indigenous species and ecosystems. Agricultural System will provide a continuous and permanent land base necessary

to support long-term agricultural production and economic activity. Lastly, settlement areas make a number of vibrant communities designated in municipal official plans and by the Ministry of Public Infrastructure Renewal. According to Protected Countryside (Ontario Regulation 59/05) Mapping, the proposed site is about 200 kilometers away. Therefore the project will have no impact on the Protected Countryside.

Conclusion

The proposed St. Clair Sombra solar farm will produce 20 MW of clean electricity to power homes in the Lambton County area. This solar farm has been designed with environmental and neighborly responsibilities in mind. Detailed erosion control, environmental monitoring and emergency response plans will be in place during construction and operation of the solar farm. This project will cause no long-term environmental damage, and will have positive environmental impacts of clean power and increased quality of runoff from the site.

Appendix A

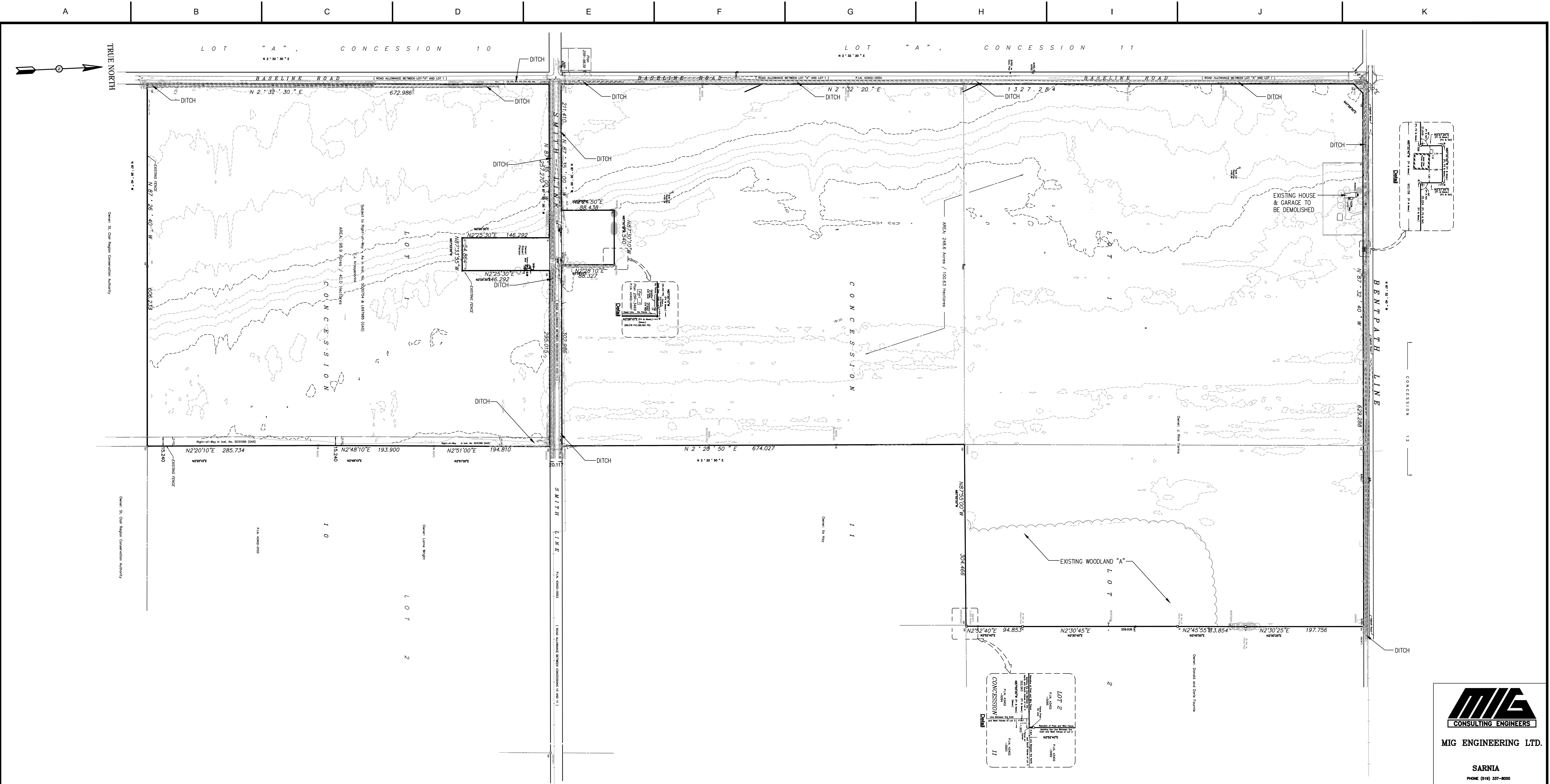
REA Site Plans



ST. CLAIR - SOMBRA SOLAR FARM

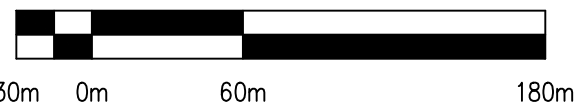
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<p>ALL WORK TO BE PERFORMED SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES OF GOVERNMENTAL AGENCIES HAVING JURISDICTION OVER THE PROJECT INCLUDING BUT NOT LIMITED TO THE TOWNSHIP OF SOMBRA BUILDING CODES. WHERE THESE CODES DO NOT APPLY, THE WORK SHALL CONFORM TO THE NATIONAL BUILDING CODE OF CANADA 2005 AND THE CANADIAN NATIONAL ELECTRIC CODE LATEST EDITION.</p> <p>THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ALL PERMITS REQUIRED TO PERFORM THE WORK.</p> <p>THE CONTRACTOR SHALL COORDINATE ALL WORK TO PREVENT CONFLICTS BETWEEN TRADES AND SHALL REPORT CONFLICTS OR INCONGRUITIES BETWEEN NEW IMPROVEMENTS AND EXISTING FACILITIES TO THE OWNER OR PROJECT MANAGER BEFORE STARTING WORK WHICH IS AFFECTED THEREBY.</p> <p>THE NOTES ON THIS SHEET ARE GENERAL AND APPLY TO THE ENTIRE PROJECT. THERE ARE MORE SPECIFIC REQUIREMENTS SHOWN OR INDICATED ON THE DRAWINGS. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS, MANUFACTURER REQUIREMENTS AND BEST PRACTICES.</p> <p>IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO ENSURE JOB SAFETY AND TO COMPLY WITH THE SAFETY REGULATIONS BY NATIONAL PROVINCIAL AND LOCAL RULES, REGULATIONS, STANDARDS AND LAWS.</p> <p>THE CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES, IMPROVEMENTS AND STRUCTURES WHETHER SHOWN ON THE DRAWINGS OR NOT, AND SHALL RESTORE TO NEW CONDITION AT NO ADDITIONAL COST IF DAMAGED DURING THE COURSE OF THE WORK. EXISTING UTILITY BOXES AND INLETS SHALL BE RESET TO CONFORM TO NEW FINISH SURFACE ELEVATIONS.</p> <p>THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO STARTING WORK AND SHALL IMMEDIATELY NOTIFY THE PROJECT MANAGER OF ANY DISCREPANCIES. UNLESS DETAILED, SPECIFIED OR OTHERWISE NOTED, CONSTRUCTION SHALL BE AS INDICATED IN THE APPLICABLE DETAILS AND GENERAL NOTES. TYPICAL DETAILS ARE MEANT TO APPLY EVEN THOUGH NOT REFERENCED AT SPECIFIC LOCATIONS ON THE DRAWINGS.</p> <p>MINOR ADJUSTMENTS TO LAYOUT OR PLACEMENT OF FACILITIES MAY OCCUR. FIRST SOLAR WILL CONSTRUCT THE SITE AND MAKE MINOR CHANGES THAT DO NOT MATERIALLY PLACE FACILITIES CLOSER TO NEIGHBORS PROPERTIES AS SHOWN ON PLANS. ANY MINOR CHANGES WILL CONFORM TO ALL APPLICABLE CODES AND BEST PRACTICES.</p> <p>THE TOWNSHIP OF SOMBRA ENGINEERING DEPARTMENT SHALL BE NOTIFIED REASONABLY (MIN. 48 HOURS) IN ADVANCE BEFORE ANY WORK IS CARRIED OUT IN THE TOWNSHIP'S RIGHT-OF-WAY.</p> <p>THE COUNTY OF LAMBTON ENGINEERING DEPARTMENT SHALL BE NOTIFIED REASONABLY (MIN. 48 HOURS) IN ADVANCE BEFORE ANY WORK IS CARRIED OUT IN THE COUNTIES' RIGHT-OF-WAY.</p> <p>THE CONTRACTOR SHALL PROVIDE A TRAFFIC CONTROL PLAN TO THE APPLICABLE ROAD AUTHORITY FOR REVIEW AND APPROVAL PRIOR TO PERFORMING ANY WORK ON A PUBLIC ROADWAY AS PER THE ONTARIO TRAFFIC MANUAL – BOOK 7</p> <p>ENSURE ALL WELLS ENCOUNTERED ON THE SITE ARE DECOMMISSIONED AS PER THE MINISTRY OF THE ENVIRONMENT'S REGULATIONS (M.O.E.). PLEASE CONTACT M.O.E. FOR DETAILS.</p> <p>ALL CONSTRUCTION SITE ENTRANCES MUST BE PAVED WITH A MINIMUM OF 100mm ASPHALT FROM THE PROPERTY LINE TO THE EDGE OF THE EXISTING ASPHALT.</p> <p>PROPER MAINTENANCE AND ISOLATION OF THE INVERTERS SHALL BE IN ACCORDANCE WITH THE ORIGINAL EQUIPMENT MANUALS.</p> <p>THE LAYOUT OF THE CABLING AND CONDUITS SHOWN IN THIS DRAWING PACKAGE IS DIAGRAMMATIC IN NATURE. FIELD ROUTING OF CABLES AND CONDUITS SHALL BE COORDINATED WITH FIRST SOLAR CONSTRUCTION PERSONNEL AND OTHER CONTRACTORS WORKING SIMULTANEOUSLY ON THIS PROJECT.</p> <p>THE SUB-CONTRACTOR SHALL ENSURE THAT WORK DOES NOT INTERRUPT ESTABLISHED OR PROJECTED DRAINAGE PATTERNS.</p> <p>ALL WRINGS AND WIRING METHODS SHALL BE INSTALLED IN ACCORDANCE WITH THE ENGINEERING PACKAGE. DEVIATIONS FROM THE DRAWINGS AND SPECIFICATIONS SHALL BE COORDINATED AND APPROVED BY FIRST SOLAR CONSTRUCTION PERSONNEL.</p> <p>ALL ENCLOSED MUNICIPAL DRAINS MUST NOT BE DAMAGED AT ANY TIME. IF A DRAIN IS DAMAGED, IT MUST BE REPAIRED AS DIRECTED BY THE TOWNSHIP OF SOMBRA.</p> <p>SEE ALL OF THE ENGINEERING DRAWINGS FOR CONSTRUCTION DETAILS, DIMENSIONS, AND DRAINAGE AND UTILITY CONNECTIONS. SITE SUB-CONTRACTOR TO VERIFY THE SIZE, LOCATION AND ELEVATION OF ALL CONNECTION AT THE BUILDING WITH THE MECHANICAL CONTRACTOR BEFORE BEGINNING CONSTRUCTION.</p> <p>BURYING OF BRUSH, STUMPS, TREES, OR CONSTRUCTION RELATED MATERIALS IS PROHIBITED.</p> <p>CONSTRUCTION LIMITS SHOULD BE IDENTIFIED AND CLEARLY MARKED TO EXCLUDE EQUIPMENT. CONSTRUCTION FENCING SHALL BE UTILIZED TO PROTECT AREAS THAT ARE NOT TO BE DISTURBED. VEGETATION & BRANCHES SHOULD BE PRUNED PROPERLY. EXISTING VEGETATION SHOULD BE PRESERVED WHERE ATTAINABLE.</p> <p>ALL EQUIPMENT, MATERIALS, ETC. SHALL BE CONFINED TO THE PROPERTY. NO ENCROACHMENT ONTO ADJACENT PROPERTIES IS PERMITTED, UNLESS SPECIFIED ON THE PLAN AND GRANTED IN WRITING.</p> <p>AREAS TO BE FILLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF TOP SOIL. REMOVE TREES, VEGETATION, ROOTS, OR OTHER UNACCEPTABLE MATERIAL. FILL MATERIAL SHALL BE FREE OF BRUSH, RUBBISH, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER ORGANIC MATERIAL.</p> <p>THE SUB-CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS, FIELD STAKES, AND OTHER SURVEY MARKERS DURING CONSTRUCTION. ALL SUCH MONUMENTS OR MARKERS DESTROYED DURING CONSTRUCTION SHALL BE REPLACED AT THE SUB-CONTRACTOR'S EXPENSE.</p>				<p>ALL ASPHALT PAVING, CONCRETE PAVING, CURBING, CONCRETE FOOTINGS, POST FOOTINGS, ROCKS OVER 4" IN SIZE, SOIL THAT WILL NOT BE REUSED FOR FILL, VEGETATION (ORGANIC MATERIALS), DEBRIS AND RUBBISH SHALL BE DISPOSED OF IN A LEGAL MANNER AS THE CONTRACTOR'S PROPERTY. ALL EDGES SHALL BE SAW-CUT FULL DEPTH TO STRAIGHT AND CLEAN LINES. DUST CONTROL SHALL BE PRACTICED THROUGHOUT DEMOLITION. THE CONTRACTOR SHALL CONFORM TO THE REQUIREMENTS OF EROSION CONTROL AND THE STORM WATER BEST MANAGEMENT PRACTICES FOR CONSTRUCTION-RELATED ACTIVITIES.</p> <p>STOCKPILING AGGREGATE</p> <p>IMPORTED GRANULAR BASE AND GRAVEL SURFACING MATERIAL SHALL BE REMOVED FROM THE AREA TO BE GRADED AND STOCKPILED ON SITE FOR REPLACEMENT FOLLOWING THE GRADING WORK.</p> <p>TRENCHING</p> <p>TRENCHING SHALL BE TRUE TO LINE AND GRADE. BACKFILL OF TRENCHES IN ROADWAYS ONLY SHALL BE COMPACTED TO 95% RELATIVE DENSITY.</p> <p>LAND PREPARATIONS</p> <p>DUST & SEDIMENT CONTROL SHALL BE PRACTICED THROUGHOUT ALL CONSTRUCTION OPERATIONS.</p> <p>TEMPORARY CUT SLOPES SHOULD NOT EXCEED 1 TO 1 (HORIZONTAL TO VERTICAL. FINISHED CUT OR COMPACTED FILL SLOPES SHOULD NOT EXCEED 2 HORIZONTAL TO 1 VERTICAL. FILL SHOULD BE PLACED IN UNIFORM LIFTS NOT TO EXCEED 200mm LIFTS AND COMPACTED TO 97% RELATIVE DENSITY. ANY ON SITE MATERIALS STOCKPILED FOR USE AS FILL MATERIAL SHALL BE FREE OF ORGANIC MATTER OR OTHER DELETERIOUS SUBSTANCES. THE MAXIMUM PARTICLE SIZE FOR FILL MATERIAL IS LIMITED TO 100mm.</p> <p>ALL DISTURBED AREAS OF THE SITE NOT PLANTED SHALL BE STABILIZED.</p> <p>TEMPORARY CONSTRUCTION HAUL ROADS</p> <p>GRAVEL ACCESS ROADS SHALL BE EXCAVATED AND THE SUB-BASE COMPACTED TO 95% SPMD. THE USE OF SEPARATION FABRICS MAY BE UTILIZED TO FACILITATE FUTURE REMOVAL AND RECOVERY OF GRANULAR MATERIALS. HAUL ROADS SHOULD HAVE AT LEAST 300mm OF CRUSHED STONE AND SHALL BE MAINTAINED DURING CONSTRUCTION.</p> <p>PRODUCTS</p> <p>PRODUCTS OR MATERIALS SPECIFIED BY NAME BRAND "OR EQUAL" ARE LISTED HEREIN TO ESTABLISH QUALITY AND BASIC PRODUCT DESIGN. THE CONTRACTOR MAY REQUEST CONSIDERATION ON THE PART OF THE PROJECT MANAGER OF ANY PRODUCT OF EQUAL OR BETTER QUALITY AND DESIGN BY SUBMITTING COMPLETE SHOP DRAWINGS AND CATALOGUE DATA SUFFICIENT FOR THE PROJECT MANAGER TO COME TO A JUDGMENT AS TO THE ACTUAL EQUALITY OF THE REQUESTED SUBSTITUTION ITEM. THE FINAL DETERMINATION OF EQUALITY WILL BE BY THE PROJECT MANAGER. CONTRACTOR SHALL NOT PURCHASE OR INSTALL SUBSTITUTED MATERIALS WITHOUT WRITTEN APPROVAL OF THE ENGINEER, ARCHITECT OR OWNER'S FIELD REPRESENTATIVE.</p> <p>GEOTECHNICAL REPORT & CONDITIONS OF APPROVAL</p> <p>ALL SITE WORK SHALL COMPLY WITH AMEC, INC. GEOTECHNICAL REPORT PROJECT NO. SW0808017 DATED 3 NOVEMBER 2008 AND ST. CLAIR, ONTARIO MUNICIPAL CODES.</p> <p>ANY LEVELING, EXCAVATION, FOUNDATION DRILLING OR OTHER EARTHWORK OPERATIONS SHALL BE PERFORMED UNDER SUPERVISION OF THE GEOTECHNICAL ENGINEER.</p>				<p>1. FOR THE TEMPORARY STOCKPILING AND TREATMENT OF EXCAVATED SOIL MATERIALS AT THE PROJECT SITE. SUB-CONTRACTOR IS AUTHORIZED TO UTILIZE THE STAGING AREA DESCRIBED ON PROJECT DRAWINGS AND OTHER TEMPORARY AREAS APPROVED BY THE CONSTRUCTION PROJECT MANAGER FOR ACCESS AND STORAGE OF WET EXCAVATED MATERIALS AS NEEDED TO PERFORM THE WORK DESCRIBED HEREIN.</p> <p>2. THE SUB-CONTRACTOR AGREES TO INDEMNIFY, DEFEND AND HOLD HARMLESS THE PROPERTY OWNER FROM AND AGAINST ANY AND ALL CLAIMS, INJURIES, DAMAGES, INCLUDING INJURY OR DEATH OF PERSONS ARISING FROM CONTRACTOR'S USE OF PREMISES HEREUNDER, OR THE USE OF THE PREMISES BY CONTRACTOR'S EMPLOYEES, AGENTS, SUB-CONTRACTOR'S INVITEES AND VOLUNTEERS, THE PROVISION OF THE PARAGRAPH SHALL SURVIVE EXPIRATION OR TERMINATION OF THE CONTRACT.</p> <p>3. SUB-CONTRACTOR AGREES TO FENCE OFF THE DESIGNATED AREA WITH A MINIMUM OF 1.8 METER HIGH CHAIN LINK FENCE PANELS, SECURED AT EACH POST.</p> <p>4. SUB-CONTRACTOR SHALL NOT STOCKPILE OR STORE CONTAMINATED MATERIALS ON THE PROJECT SITE.</p> <p>5. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ASSEMBLE THE SITE SPECIFIC EMP AND AGREES TO ADHERE TO ALL OF THE POLICIES AND PROCEDURES OF THE EMP. SUB-CONTRACTOR AGREES TO UTILIZE BEST MANAGEMENT PRACTICES (BMPS) AS LONG AS THIS AGREEMENT IS IN EFFECT. BMPS SHALL INCLUDE STABILIZE CONSTRUCTION ACCESS FROM THE PUBLIC RIGHT-OF-WAY OR PAVED STREET, EROSION PROTECTION FOR THE PERIMETER OF THE ACCESS AREA, PROTECTION FOR ALL MATERIALS ON-SITE, WASHOUT PITS, PERIMETER CONTROL WITH WADDLES OR SILT FENCING, OR SUITABLE ALTERNATIVE, AS WELL AS DRY STREET SWEEPING AS NECESSARY. SUB-CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXPENSES ASSOCIATED WITH IMPLEMENTATION AND MAINTENANCE OF BMPS DURING THE COURSE OF THE WORK. SUB-CONTRACTOR AGREES TO HOLD FIRST SOLAR, ENGINEER OF RECORD AND THE PROPERTY OWNER HARMLESS FOR ANY CLAIMS OR FINES WITH REGARD TO EMP AS THEY SPECIFICALLY RELATE TO THE SITE IDENTIFIED FOR THE RIGHT-OF-ENTRY, OR IF CONTRACTOR IS FOUND TO BE IN DIRECT NEGLIGENCE WITH THE EMP.</p> <p>6. SUB-CONTRACTOR SHALL RESTORE ANY TEMPORARY STOCKPILE SITE TO EQUAL OR BETTER CONDITION UPON COMPLETION OF THE PROJECT. THE CONTRACTOR SHALL CONDUCT A PRE-INSPECTION PRIOR TO ANY ACTIVITIES REPRESENTATIVE PRIOR TO ACCEPTANCE OF THE WORK.</p> <p>TEMPORARY LAYDOWN, TRAILER AND PARKING AREAS</p> <p>TEMPORARY LAYDOWN, TRAILER, AND PARKING AREAS WILL BE RESTORED TO PRE-EXISTING CONDITION (TOPSOIL/GRASS) FOLLOWING COMPLETION OF CONSTRUCTION.</p> <p>SITE WORK</p> <p>1. THE WORK TO BE PERFORMED UNDER THIS CONTRACT INCLUDES THE FURNISHING OF ALL LABOR, MATERIALS AND EQUIPMENT FOR THE PROJECT. THE WORK CONSISTS OF:</p> <p>A. INSTALL SOIL EROSION AND SEDIMENT CONTROL MEASURES.</p> <p>B. CONSTRUCT SITE ACCESS ENTRANCE FROM PUBLIC ROAD INTO PROJECT SITE.</p> <p>C. CONSTRUCT CHAIN LINK FENCE (AS DESIGNED) & STAGING AND LAY-DOWN AREAS (INCLUDING TRAILERS, GUARD BOOTH, AND PARKING AREAS).</p> <p>D. STRIP TOP SOIL AND STOCKPILE (FOR PROCEDURE SEE SHEET REA-08).</p> <p>E. PERFORM SITE PREPARATION LEVELING, ROUGH GRADING, AND COMPACTION FOR THE PROJECT AREA.</p> <p>F. INSTALL DRAINAGE FEATURES, AND CONSTRUCT ONSITE ACCESS ROADS DELINEATED ON THE DRAWING FOLLOWING THE INSTALLATION OF UNDERGROUND UTILITIES IN THESE SELECTED ROADWAYS.</p> <p>G. PERFORM FINAL GRADING.</p> <p>H. INSTALLATION OF POSTS AS DESIGNED;</p> <p>I. ALL OTHER WORKS DESCRIBED ON THE DRAWINGS AND THE SPECIFICATIONS, INCLUDING SOLAR PANELS, PCS SHELTER, TRANSFORMERS, ELECTRICAL WIRING, AND REMAINDER OF SYSTEM COMPONENTS.</p> <p>J. BEGIN LANDSCAPING / SEEDING INSTALLED; INSTALL FINAL STABILIZATION MEASURES.</p> <p>K. BRING SYSTEM ON-LINE.</p> <p>L. REMOVE CONSTRUCTION EQUIPMENT, TRAILERS, DE-MOBILIZE, ETC.</p> <p>M. REMOVE SOIL EROSION AND SEDIMENT CONTROL MEASURES; FINALIZE LANDSCAPING & SEEDING.</p> <p>N. TURN PROJECT OVER TO THE CLIENT;</p>				<p>A AMPERE(S)</p> <p>AC ALTERNATING CURRENT</p> <p>AL ALUMINUM</p> <p>ALT ALTERNATE</p> <p>APPROX. APPROXIMATE</p> <p>BLDG. BUILDING</p> <p>BLKG BLOCKING</p> <p>BM BEAM</p> <p>BMRK BENCHMARK</p> <p>BOT BOTTOM</p> <p>BW BOTTOM OF EXISTING WALL</p> <p>CL CENTER LINE</p> <p>C CONDUIT</p> <p>CATV CABLE TELEVISION</p> <p>CB CIRCUIT BREAKER</p> <p>CKT CIRCUIT</p> <p>CLR CLEAR/CLEARANCE</p> <p>CMP CORRUGATED METAL PIPE</p> <p>CO CLEAN OUT SEWER</p> <p>COL COLUMN</p> <p>CONC CONCRETE</p> <p>COND CONDUCTOR</p> <p>CY CUBIC YARD</p> <p>D DEPTH</p> <p>DBL DOUBLE</p> <p>DC DIRECT CURRENT</p> <p>DEMO DEMOLITION</p> <p>DET DETAIL</p> <p>DG DESIGN GRADE</p> <p>DI DROP INLET</p> <p>DIP DUCTILE IRON PIPE</p> <p>DISC DISCONNECT SWITCH</p> <p>DN DOWN</p> <p>DWG DRAWING(S)</p> <p>E EASTING</p> <p>ELEV ELEVATION</p> <p>EOR ENGINEER OF RECORD</p> <p>EP EDGE OF PAVEMENT</p> <p>EQ EQUAL</p> <p>E-TBR EXISTING TO BE REMOVED</p> <p>EX EXISTING</p> <p>FF FINISHED FLOOR</p> <p>FG FINISHED GRADE</p> <p>FH FIRE HYDRANT</p> <p>FL FLOW LINE</p> <p>FSE/FS FIRST SOLAR ELECTRIC/FIRST SOLAR</p> <p>FT FOOT/FEET</p> <p>GA GAGE/GAUGE</p> <p>GB GAGE/GAUGE</p> <p>GALV GRADE BREAK</p> <p>GALV GALVANIZE</p> <p>GR GRADE</p> <p>HP HIGH POINT</p> <p>HZ HEIGHT</p> <p>ID INSIDE DIAMETER</p> <p>INV INVERT</p> <p>JB JUNCTION BOX</p> <p>K KEY OPERATED</p> <p>KW KILOWATT(S)</p> <p>L LINE</p> <p>LF LINEAR FEET</p> <p>LL LIVE LOAD</p> <p>MFR MANUFACTURER</p> <p>MAX MAXIMUM</p> <p>MH MANHOLE</p> <p>MTL METAL</p> <p>MIN MEGAWATT</p> <p>N MINIMUM</p> <p># NUMBER</p> <p>NC NEUTRAL</p> <p>NOM NORMALLY CLOSED</p> <p>NTS NOMINAL</p> <p>OC NOT TO SCALE</p> <p>OD ON CENTER</p> <p>Ø OUTSIDE DIAMETER</p> <p>PCC PROPERTY LINE</p> <p>PCF PRECAST CONCRETE</p> <p>PCS POUNDS PER CUBIC FOOT</p> <p>PH POWER CONVERSION STARTER</p> <p>POC PHASE</p> <p>PVC POINT OF CONNECTION</p> <p>PVCS POLYVINYL CHLORIDE</p> <p>PVS PHOTOVOLTAIC COMBINING SWITCHGEAR</p> <p>R PHOTOVOLTAIC INTERCONNECTION SWITCHGEAR</p> <p>RC RADIUS</p> <p>RCS REINFORCED CONCRETE</p> <p>RIGD RIGID GALVANIZED STEEL</p> <p>R/W RIGHT-OF-WAY</p> <p>SD STORM DRAIN</p> <p>SL STREET LIGHT</p> <p>SPEC SPECIFICATION</p> <p>SQ SQUARE</p> <p>SS SANITARY SEWER</p> <p>SST STAINLESS STEEL</p> <p>STA STATION</p> <p>STD STANDARD</p> <p>STL STEEL</p> <p>SW SWITCH</p> <p>T TELEPHONE</p> <p>TB TERMINAL BLOCK</p> <p>TEMP TEMPORARY</p> <p>THK THICK</p> <p>TW TOP OF WALL</p> <p>TYP TYPICAL</p> <p>VF VERIFY IN FIELD</p> <p>VERT VERTICAL</p> <p>W WATT(S)</p> <p>W/ WITH</p> <p>WP WEATHERPROOF</p> <p>XFMR TRANSFORMER</p>				<p>BOUNDARY LINE</p> <p>EASEMENT</p> <p>EXISTING MAJOR CONTOUR (m)</p> <p>EXISTING MINOR CONTOUR (m)</p> <p>PROPOSED CONTOUR</p> <p>EXISTING EP PIPELINE</p> <p>EXISTING ELECTRICAL</p> <p>EXISTING WATER MAIN</p> <p>EXISTING STORM DRAIN</p> <p>EXISTING POWER POLE</p> <p>EXISTING FIRE HYDRANT</p> <p>RAILROADS</p> <p>WOODED AREAS</p> <p>TRANSFORMER</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
APPLICABLE CODES AND STANDARDS				1. 2005 NATIONAL BUILDING CODE OF CANADA				2. 2006 ONTARIO BUILDING CODE				3. SOMBRA MUNICIPAL CODE – LATEST EDITION				4. ASCE 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES				5. AMERICAN INSTITUTE OF STEEL AND CONSTRUCTION, 13TH EDITION (AISC).				6. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)				7. 2002 ONTARIO ELECTRICAL SAFETY CODE, 23RD EDITION				8. UL-UNDERWRITERS LABORATORIES OF CANADA				9. (IEC) INTERNATIONAL ELECTRICAL COMMISSION				10. 2006 CANADIAN ELECTRICAL CODE				11. CCOHS CANADIAN CENTER FOR OCCUPATIONAL HEALTH & SAFETY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
THIS PUBLICATION CONTAINS VALUABLE PROPRIETARY AND CONFIDENTIAL INFORMATION OF FIRST SOLAR, INC. ("FIRST SOLAR") WHO RETAINS ALL COPYRIGHT RIGHTS TO IT UNDER 17 U.S.C. SECTION 106 AND IS PROTECTED BY U.S. AND INTERNATIONAL LAW. ANY REPRODUCTION, PREPARATION OF DERIVATIVE WORKS, DISTRIBUTION, PUBLIC PERFORMANCE OR DISPLAY, DISCLOSURE, AND/OR USE OF ALL, OR ANY PORTION, OF THIS PUBLICATION IN ANY FORM OR MEDIUM WITHOUT SPECIFIC WRITTEN AUTHORIZATION FROM FIRST SOLAR IS STRICTLY PROHIBITED.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							



EXISTING CONDITIONS PLAN

SCALE: 1m = 3000m



NOTES AND LEGEND

BEARINGS ARE UTM GRID (NAD 83), DERIVED FROM GPS OBSERVATIONS AND THE CAN-NET BASE STATION NETWORK, AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.

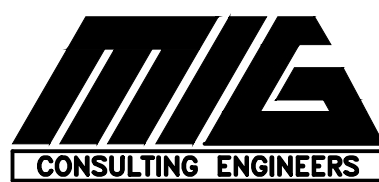
- DENOTES SURVEY MONUMENT FOUND
- ⊕ DENOTES SURVEY MONUMENT SET
- SIB DENOTES STANDARD IRON BAR
- SSIB DENOTES SHORT STANDARD IRON BAR
- IB DENOTES IRON BAR
- PWF DENOTES POST AND WIRE FENCE
- WIT DENOTES WITNESS
- FKS DENOTES FARNCOMB, KIRKPATRICK & STIRLING, O.L.S.'s
- MS DENOTES MONTEITH AND SUTHERLAND LIMITED, O.L.S.'s
- 886 DENOTES D.C. McGEORGE, O.L.S.

- 1665 DENOTES R.A. MacKENZIE, O.L.S.
- RWR DENOTES R. ROBERTSON, O.L.S.
- P1 DENOTES PLAN OF SURVEY BY MONTEITH AND SUTHERLAND LIMITED DATED NOVEMBER 8th, 2008. PLAN No. E-1217-2, FILE No. SOM-750
- P2 DENOTES PLAN 977 "PLANS AND PROFILES"
- P3 DENOTES PLAN 25R-9639
- P4 DENOTES PLAN OF SURVEY BY MONTEITH AND SUTHERLAND LIMITED DATED NOVEMBER 6th, 2008. PLAN No. E-1217-1, FILE No. SOM-750
- P5 DENOTES PLAN 25R-3469
- P6 DENOTES PLAN OF SURVEY BY MONTEITH AND SUTHERLAND LIMITED DATED NOVEMBER 6th, 2008. PLAN No. F-5889, FILE No. SOM-750
- P7 DENOTES PLAN 25R-9180

SITE AREA:

AREA = 140.63 HECTARES (347.5 ACRES)

TOPOGRAPHICAL PLAN OF SURVEY
OF PART OF
LOTS 1 and 2, CONCESSION 11
(GEOGRAPHIC TOWNSHIP OF SOMBRA)
AND PART OF
LOT 1, CONCESSION 10
(GEOGRAPHIC TOWNSHIP OF SOMBRA)
NOW IN THE
TOWNSHIP OF ST. CLAIR
COUNTY OF LAMBTON



MIG ENGINEERING LTD.

SARNIA
PHONE (519) 337-8000

F	06-22-2010	RE-ISSUED FOR REA PERMIT	FWD	AJT	MP
E	04-28-2010	REISSUED FOR REA PERMIT	DHD	MP	TZ
D	04-06-2010	REISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	REISSUED FOR REA PERMIT	MP	CE	TZ
B	12-14-2009	ISSUED FOR REA PERMIT	FWD	CE	TZ
A	12-12-2009	ISSUED FOR APPROVAL	FWD	MP	TZ
REV	DATE	REVISION DESCRIPTION	BY	CHK	APP



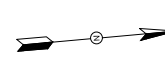
FIRST SOLAR DEVELOPMENT
(CANADA), INC.
5115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

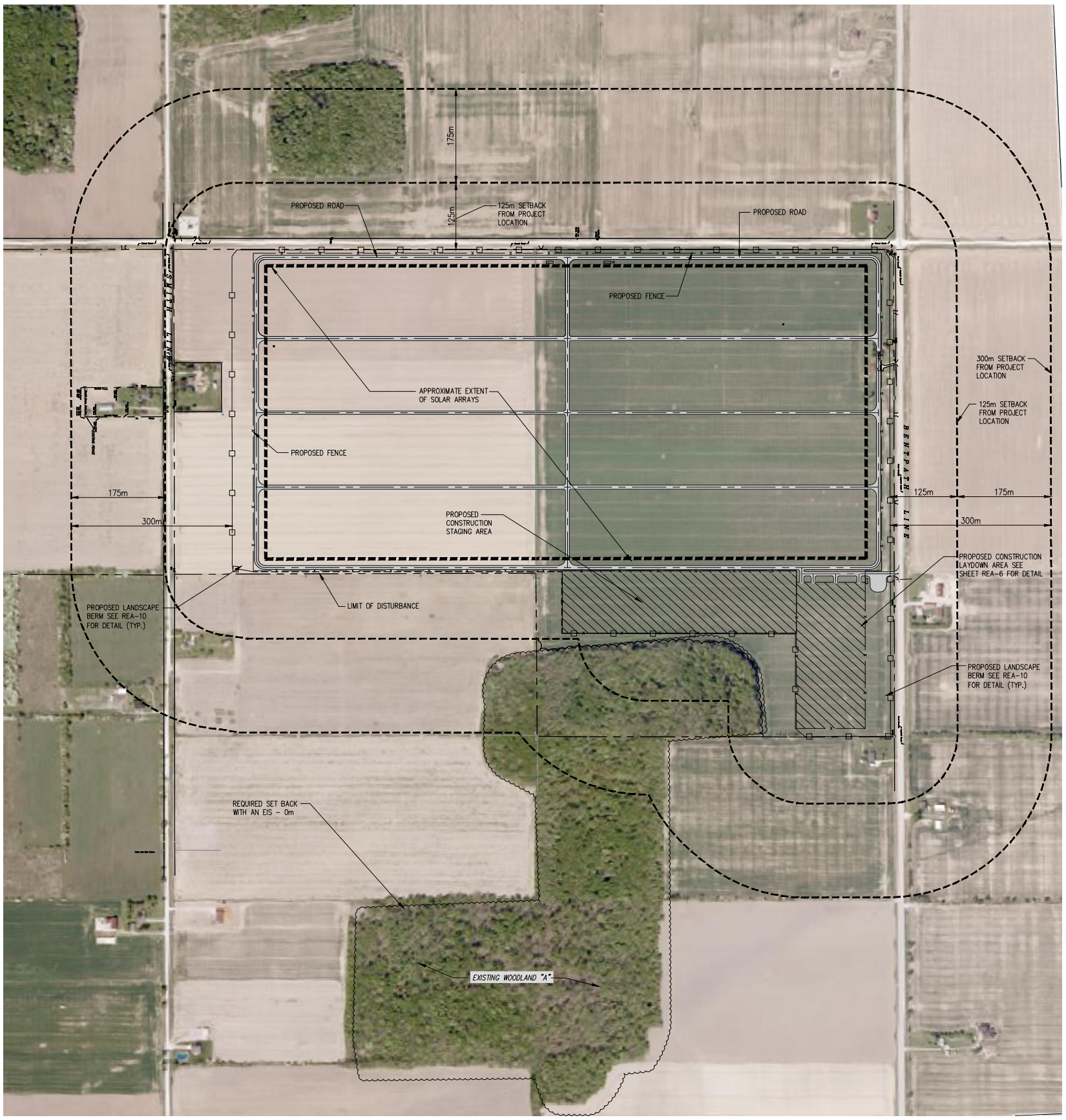
PROJECT: ST. CLAIR - SOMBRA SOLAR FARM				
TITLE: EXISTING CONDITIONS PLAN				
PROJ. ENR. KEITH SYMMERS	PROJ. ENR. TOM ZACCARIA	DR. BY FWD	CHK. BY MP	SCALE: AS SHOWN
PROJ. DIRECTOR MARK LANGDON	DRAWING NO.		REV.	
FS ELEC. JOB No:	5028-0102-22		F	

THIS PRINT IS NOT TO BE USED FOR CONSTRUCTION UNLESS NOTED AND SIGNED OK FOR CONSTRUCTION ABOVE LAST REVISION.

A B C D E F G H I J K



1
2
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4
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8



OVERALL CONSTRAINTS MAP




Within 300 Metres of Project Location:	
Buildings	As Shown on Plan
Structures	As Shown on Plan
Roads	As Shown on Plan
Utility Corridors	As Shown on Plan
Rights-of-Way	As Shown on Plan
Easements	As Shown on Plan
Within 125 Metres of Project Location:	
Property subject of an agreement, covenant or easement under clause 10(1)(b) of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property intended to be designated as of cultural heritage value or interest under section 29 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property of cultural heritage value or interest under section 29 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property of cultural heritage value or interest of provincial significance under section 34.5 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property intended to be designated as of cultural heritage value or interest of provincial significance under section 34.6 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property subject of an easement or covenant under section 37 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property that is part of an area designated as a heritage conservation district under section 41 of the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Property designated as a historic site under Regulation 880 of the Revised Regulations of Ontario under the OHA	N/A - None Within 125 m - See "Protected Properties Report & Heritage Assessment"
Heritage Resources	N/A - See "Protected Properties Report & Heritage Assessment"
Archaeological Resources	See "Letter of Concurrence Stage 2 and 3"
Oak Ridges Moraine Conservation Plan Area	N/A - Not Within 125 m - See "Design and Operations Report"
Niagara Escarpment Plan Area	N/A - Not Within 125 m - See "Design and Operations Report"
Protected Countryside	N/A - Not Within 125 m - See "Design and Operations Report"
Lake Simcoe Protection Act Watershed Boundary	N/A - Not Within 125 m - See "Design and Operations Report"

NOTE:

1. PROJECT LOCATION IS DEFINED AS THE LIMIT OF DISTURBANCE ASSOCIATED WITH THE DEVELOPMENT OF THE PROJECT.
2. IMAGE SOURCE - GOOGLE EARTH IMAGE, TAKEN DECEMBER 10, 2009.

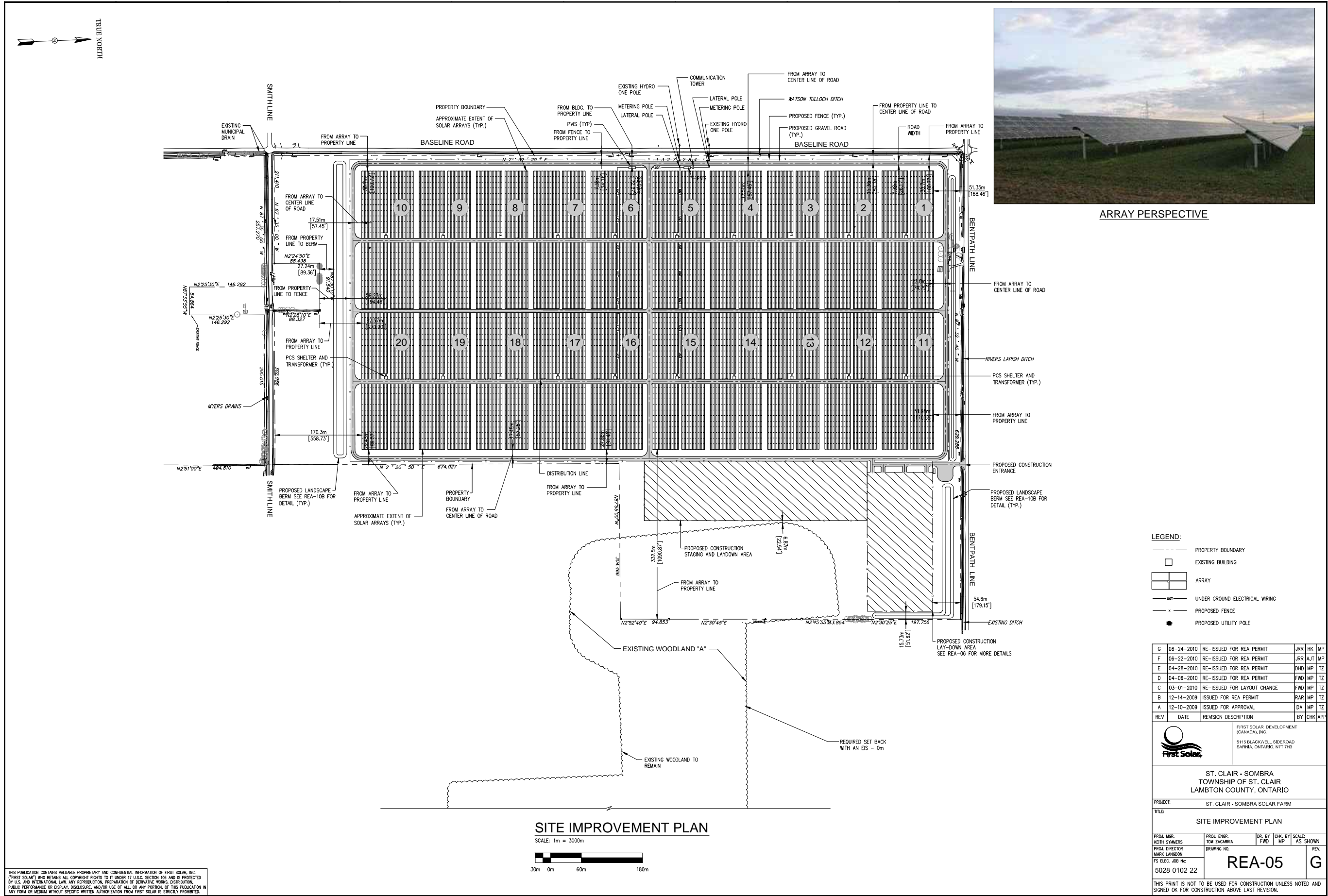
LEGEND:

- PROPERTY BOUNDARY
- ARRAY BOUNDARY
- PROPOSED FENCE
- PROPOSED SILT FENCE / LIMIT OF DISTURBANCE
- PROPOSED UPHILL LIMIT OF DISTURBANCE
- SETBACK LINE

F	08-24-2010	RE-ISSUED FOR REA PERMIT	FWD	HK	MP
E	06-22-2010	RE-ISSUED FOR REA PERMIT	FWD	CE	MP
D	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
B	12-23-2009	ISSUED FOR REA PERMIT	RAR	MP	TZ
A	12-10-2009	ISSUED FOR APPROVAL	DA	MP	TZ
REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
			FIRST SOLAR DEVELOPMENT (CANADA), INC. 5115 BLACKWELL SIDEROAD SARNIA, ONTARIO, N7T 7H3		
ST. CLAIR - SOMBRA TOWNSHIP OF ST. CLAIR LAMBTON COUNTY, ONTARIO					
PROJECT: ST. CLAIR - SOMBRA SOLAR FARM					
TITLE: OVERALL CONSTRAINTS MAP					
PROJ. MGR. KEITH SUMMERS		PROJ. ENGR. TOM ZACARRIA		DR. BY FWD	
PROJ. DIRECTOR MARK LANGDON		DRAWING NO. 5028-0102-22		CHK. BY MP	
FS ELEC. JOB No:		DRAWING NO.		REV.	
		REA-04		F	
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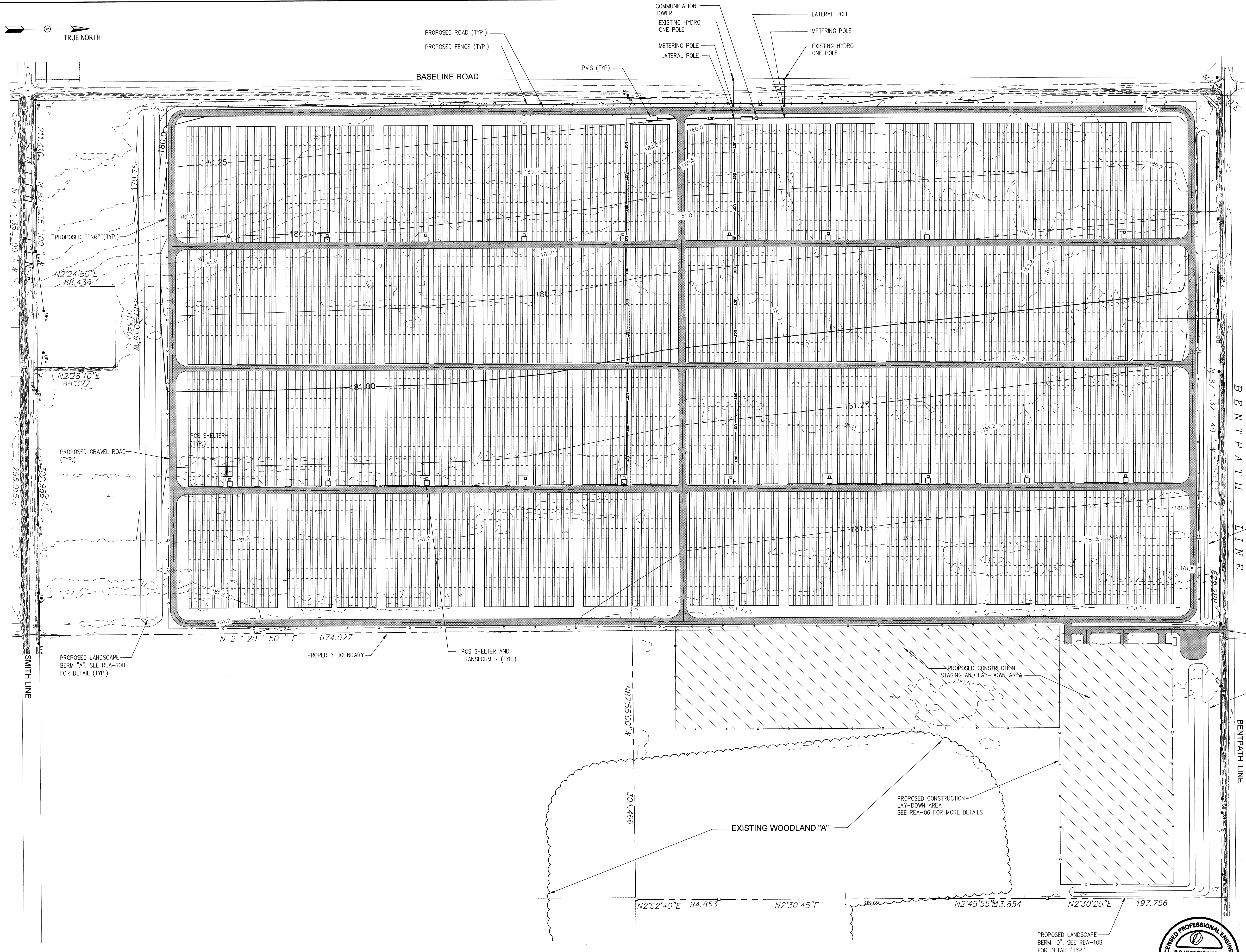
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LEGEND:


- PROPERTY BOUNDARY
- ARRAY BOUNDARY
- UNDER GROUND ELECTRICAL WIRING
- PROPOSED FENCE
- RAILROAD
- GAS LINE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- ARRAY

PROPOSED LANDSCAPE
BERM "B". SEE REA-10B
FOR DETAIL (TYP.)

PROPOSED CONSTRUCTION
ENTRANCE

PROPOSED LANDSCAPE
BERM "C". SEE REA-10B
FOR DETAIL (TYP.)

F	08-24-2010	RE-ISSUED FOR REA PERMIT	FWD	HK	MP
E	06-22-2010	RE-ISSUED FOR REA PERMIT	FWD	AJT	MP
D	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	RE-ISSUED FOR REA PERMIT	MP	CE	TZ
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REV	DATE	REVISION DESCRIPTION	BY	CHK	APP

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SARNIA, ONTARIO, N7T 7H3

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TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

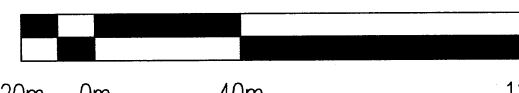
TITLE: GRADING PLAN

PROJ. MGR. KEITH SYMMERS	PROJ. ENGR. TOM ZACCARIA	DR. BY FWD	CHK. BY CE	SCALE AS SHOWN	REV.
PROJ. DIRECTOR MARK LANGDON	FS ELEC. JOB No: 5028-0102-22	DRAWING NO. REA-07			F

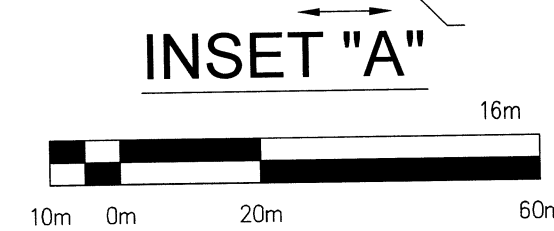
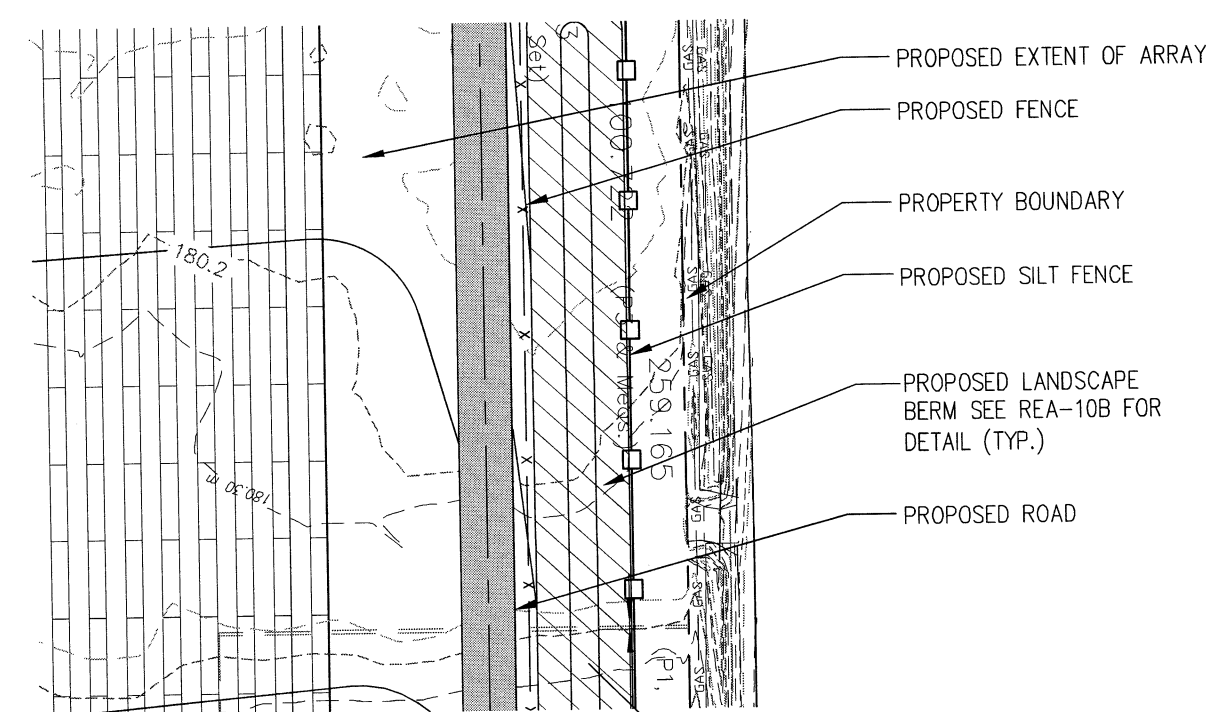
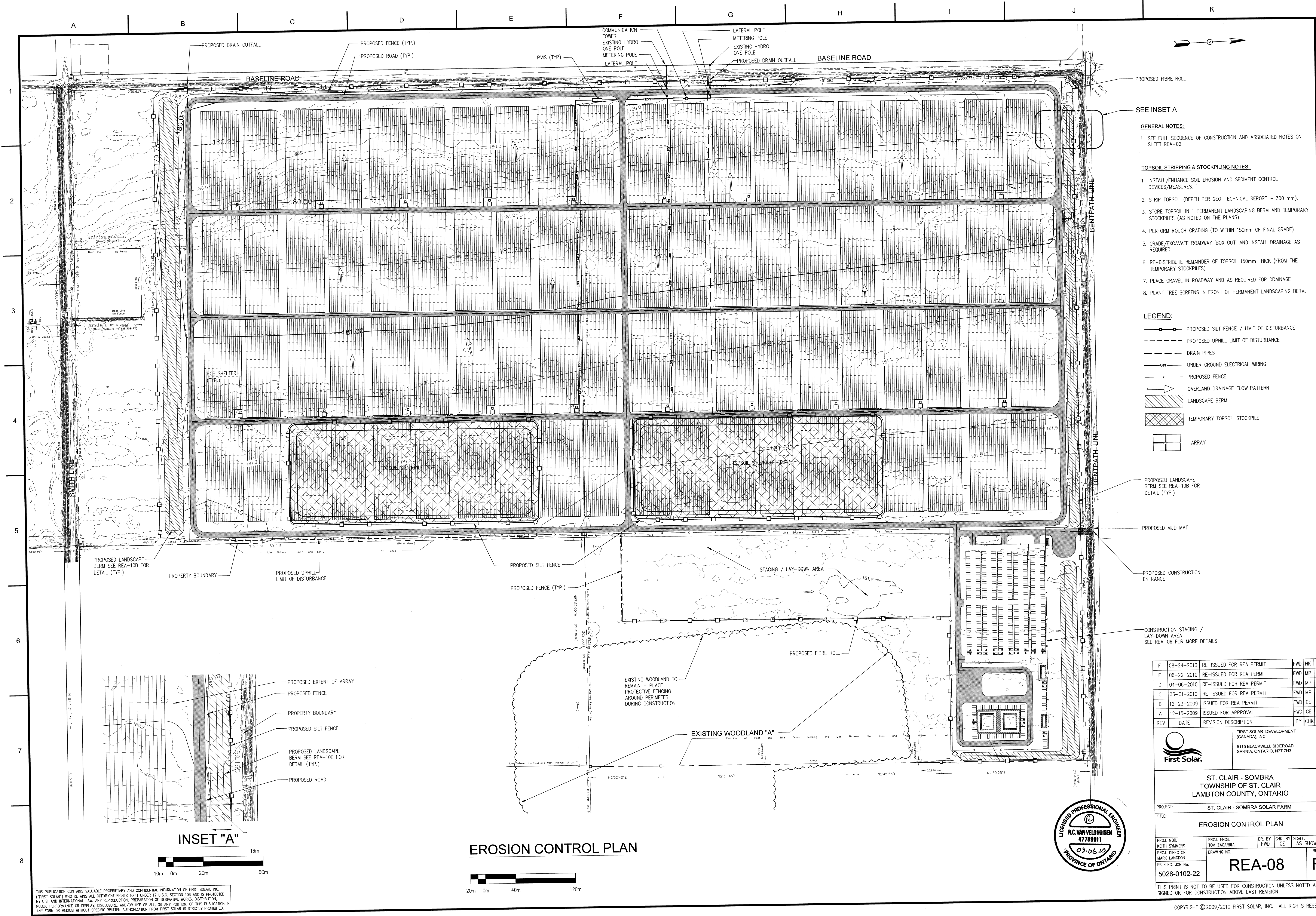
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GRADING PLAN

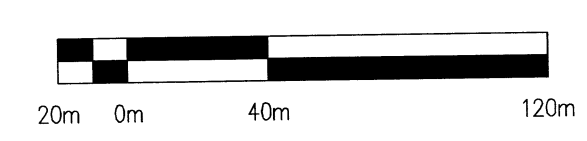
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EROSION CONTROL PLAN



- GENERAL NOTES:
- SEE FULL SEQUENCE OF CONSTRUCTION AND ASSOCIATED NOTES ON SHEET REA-02
- TOPSOIL STRIPPING & STOCKPILING NOTES:
- INSTALL/ENHANCE SOIL EROSION AND SEDIMENT CONTROL DEVICES/MEASURES.
 - STRIP TOPSOIL (DEPTH PER GEO-TECHNICAL REPORT ~ 300 mm).
 - STORE TOPSOIL IN 1 PERMANENT LANDSCAPING BERM AND TEMPORARY STOCKPILES (AS NOTED ON THE PLANS)
 - PERFORM ROUGH GRADING (TO WITHIN 150mm OF FINAL GRADE)
 - GRADE/EXCAVATE ROADWAY 'BOX OUT' AND INSTALL DRAINAGE AS REQUIRED
 - RE-DISTRIBUTE REMAINDER OF TOPSOIL 150mm THICK (FROM THE TEMPORARY STOCKPILES)
 - PLACE GRAVEL IN ROADWAY AND AS REQUIRED FOR DRAINAGE
 - PLANT TREE SCREENS IN FRONT OF PERMANENT LANDSCAPING BERM.

- LEGEND:
- PROPOSED SILT FENCE / LIMIT OF DISTURBANCE
 - PROPOSED UPHILL LIMIT OF DISTURBANCE
 - DRAIN PIPES
 - UNDER GROUND ELECTRICAL WIRING
 - PROPOSED FENCE
 - OVERLAND DRAINAGE FLOW PATTERN
 - LANDSCAPE BERM
 - TEMPORARY TOPSOIL STOCKPILE
 - ARRAY

- PROPOSED LANDSCAPE BERM SEE REA-10B FOR DETAIL (TYP.)
- PROPOSED MUD MAT
- PROPOSED CONSTRUCTION ENTRANCE
- CONSTRUCTION STAGING / LAY-DOWN AREA SEE REA-06 FOR MORE DETAILS
- STAGING / LAY-DOWN AREA
- EXISTING WOODLAND TO REMAIN - PLACE PROTECTIVE FENCING AROUND PERIMETER DURING CONSTRUCTION
- EXISTING WOODLAND "A"

F	08-24-2010	RE-ISSUED FOR REA PERMIT	FWD	HK	T2
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REV	DATE	REVISION DESCRIPTION	BY	CHK	APP

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3115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: EROSION CONTROL PLAN

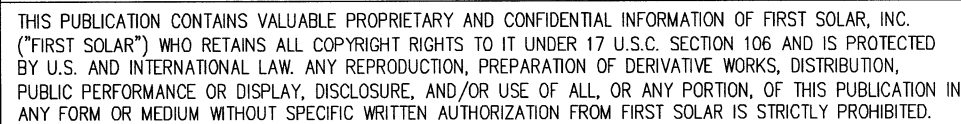
PROJ. MGR. KEITH SYMMERS	PROJ. ENGR. TOM ZACHARIA	DR. BY FWD	CHK. BY CE	SCALE AS SHOWN
PROJ. DIRECTOR MARK LANGDON	DRAWING NO.			
FS ELEC. JOB No: 5028-0102-22	REA-08			

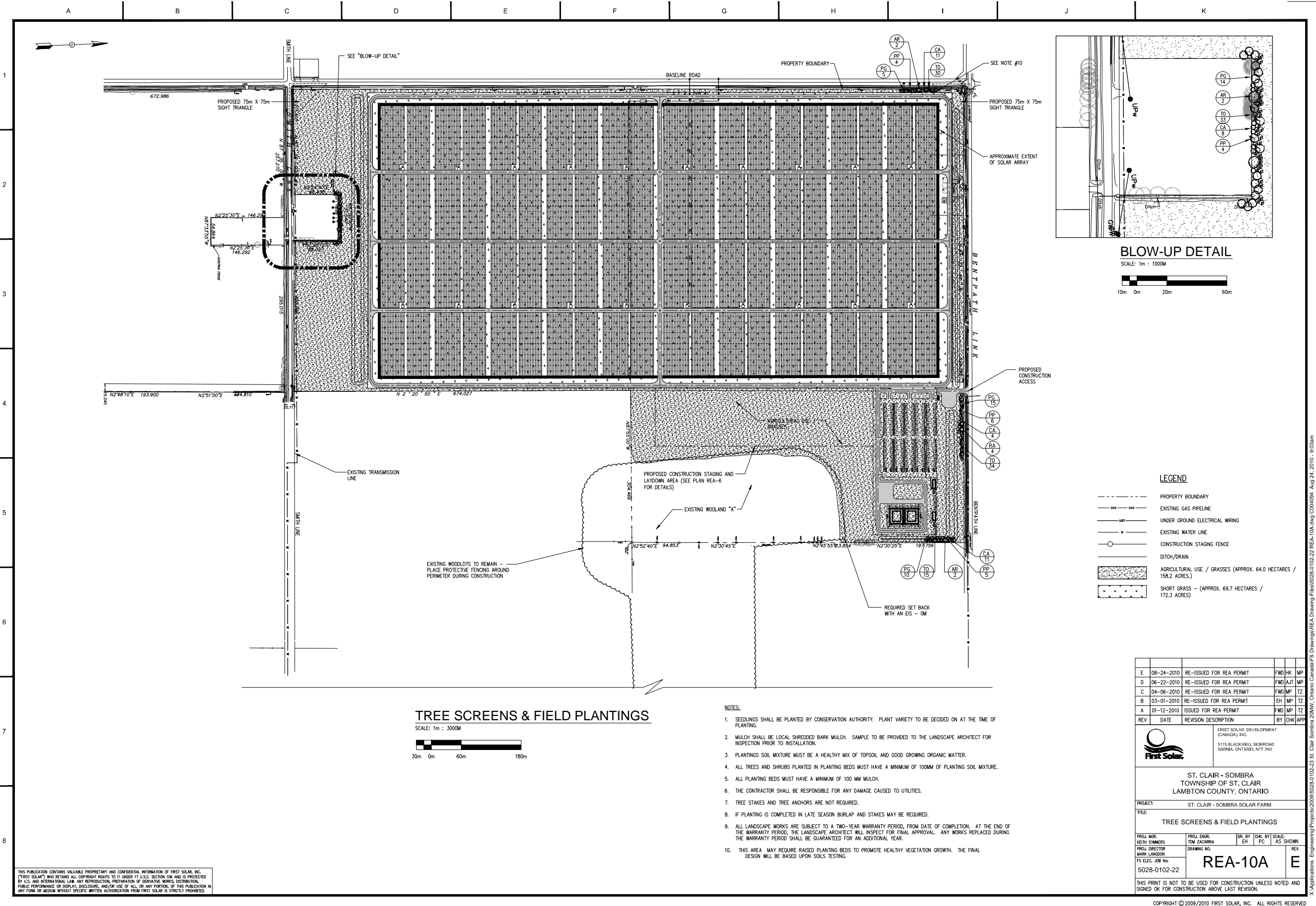
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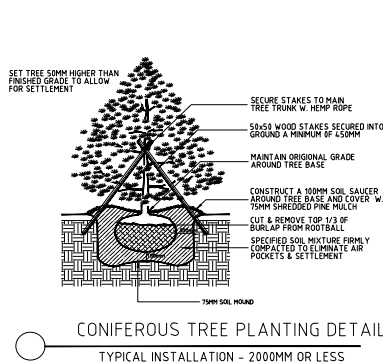
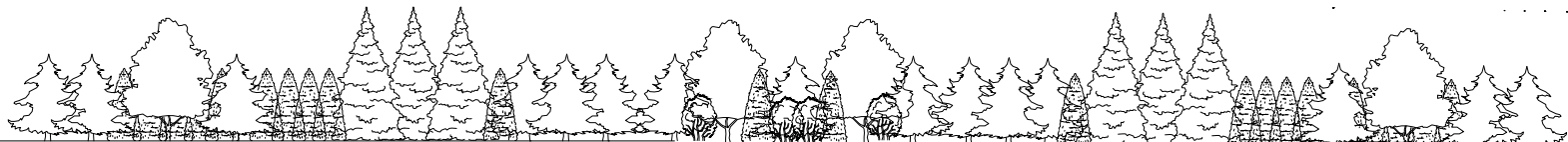
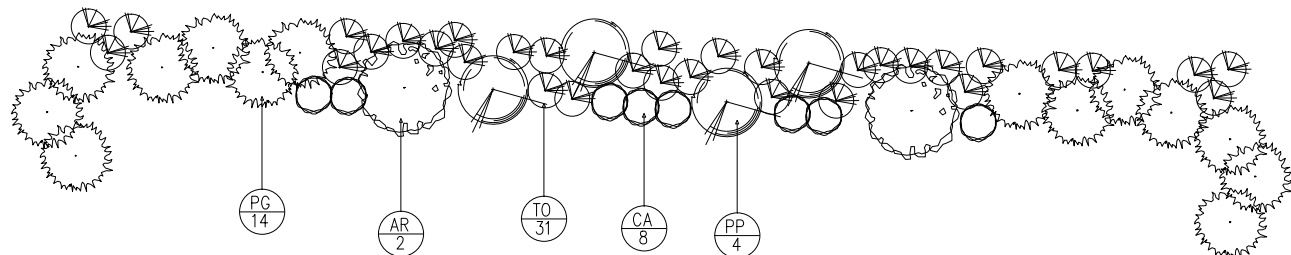
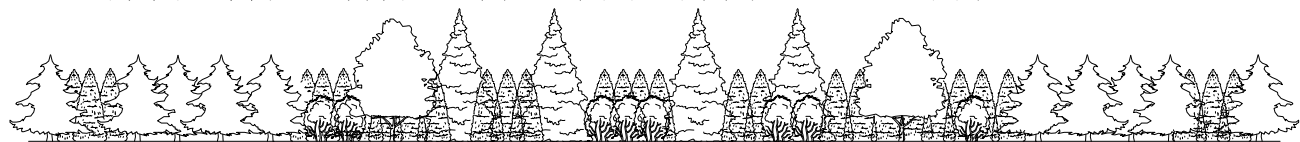
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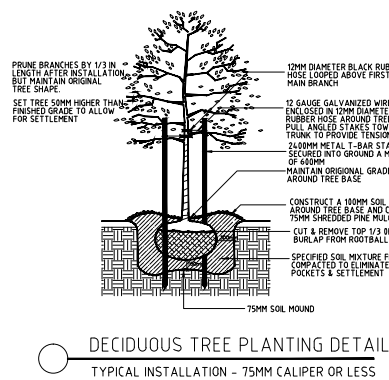
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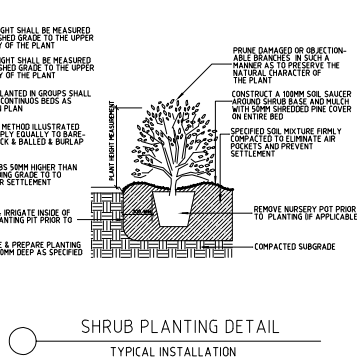




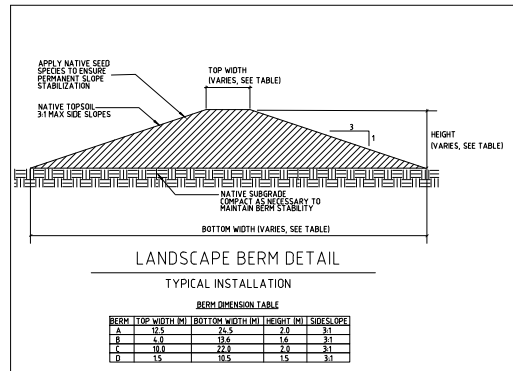
CONIFEROUS TREE PLANTING DETAIL
TYPICAL INSTALLATION - 2000MM OR LESS



DECIDUOUS TREE PLANTING DETAIL
TYPICAL INSTALLATION - 75MM CALIPER OR LESS



SHRUB PLANTING DETAIL
TYPICAL INSTALLATION



LANDSCAPE BERM DETAIL
TYPICAL INSTALLATION

BERM DIMENSION TABLE					
BUSH	TOP WIDTH (MM)	BOTTOM WIDTH (MM)	HEIGHT (MM)	SIDE SLOPE	
1	150	150	200	3:1	
2	150	150	150	3:1	
3	150	150	100	3:1	
4	150	150	50	3:1	

- NOTES**
- SEEDLINGS TO BE PLANTED BY CONSERVATION AUTHORITY. PLANT VARIETY TO BE DECIDED ON AT THE TIME OF PLANTING.
 - ALL PLANT SUBSTITUTIONS SHALL BE APPROVED IN WRITING BY THE LANDSCAPE ARCHITECT.
 - MULCH SHALL BE LOCAL SHREDDED BARK MULCH. SAMPLE TO BE PROVIDED TO THE LANDSCAPE ARCHITECT FOR INSPECTION PRIOR TO INSTALLATION.
 - ALL PLANTINGS ARE TO BE LAID OUT ON SITE BY CONTRACTOR AND APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. ANY DEVIATIONS FROM THE APPROVED LANDSCAPE PLANS REQUIRE PRIOR APPROVAL.
 - ALL PLANT MATERIAL IS TO BE INSPECTED AND APPROVED BY THE LANDSCAPE ARCHITECT. THE LANDSCAPE ARCHITECT HAS THE RIGHT TO REFUSE ANY PLANT MATERIAL BEFORE AND AFTER INSTALLATION.
 - PLANTINGS SOIL MIXTURE MUST BE A HEALTHY MIX OF TOPSOIL AND GOOD GROWING ORGANIC MATTER.
 - ALL TREES AND SHRUBS PLANTED IN PLANTING BEDS MUST HAVE A MINIMUM OF 100MM OF PLANTING SOIL MIXTURE.
 - ALL PLANTING BEDS MUST HAVE A MINIMUM OF 100 MM MULCH.
 - THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE CAUSED TO UTILITIES.
 - TREE STAKES AND TREE ANCHORS ARE NOT REQUIRED.
 - IF PLANTING IS COMPLETED IN LATE SEASON BURLAP AND STAKES MAY BE REQUIRED.
 - ALL LANDSCAPE WORKS ARE SUBJECT TO A TWO YEAR WARRANTY PERIOD, FROM DATE OF COMPLETION. AT THE END OF THE WARRANTY PERIOD, THE LANDSCAPE ARCHITECT WILL INSPECT FOR FINAL APPROVAL. ANY WORKS RELATED DURING THE WARRANTY PERIOD SHALL BE GUARANTEED FOR AN ADDITIONAL YEAR.

MASTER PLANT LIST

KEY	QUANTITY	BOTANICAL NAME	COMMON NAME	SIZE & CONDITION
AR	9	Acer rubrum	Red Maple	50mm Wire Basket (W.B.)
CA	20	Cornus alba 'elegantissima'	Silver Leaf Dogwood	60cm 3gal.
PG	34	Picea glauca	White Spruce	200cm Wire Basket (W.B.)
PP	7	Picea pungens 'Glaucous'	Colorado Blue Spruce	200cm Wire Basket (W.B.)
TO	67	Thuja occidentalis 'Nigra'	Black Cedar	275cm Wire Basket (W.B.)

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B	03-01-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
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LAMBTON COUNTY, ONTARIO

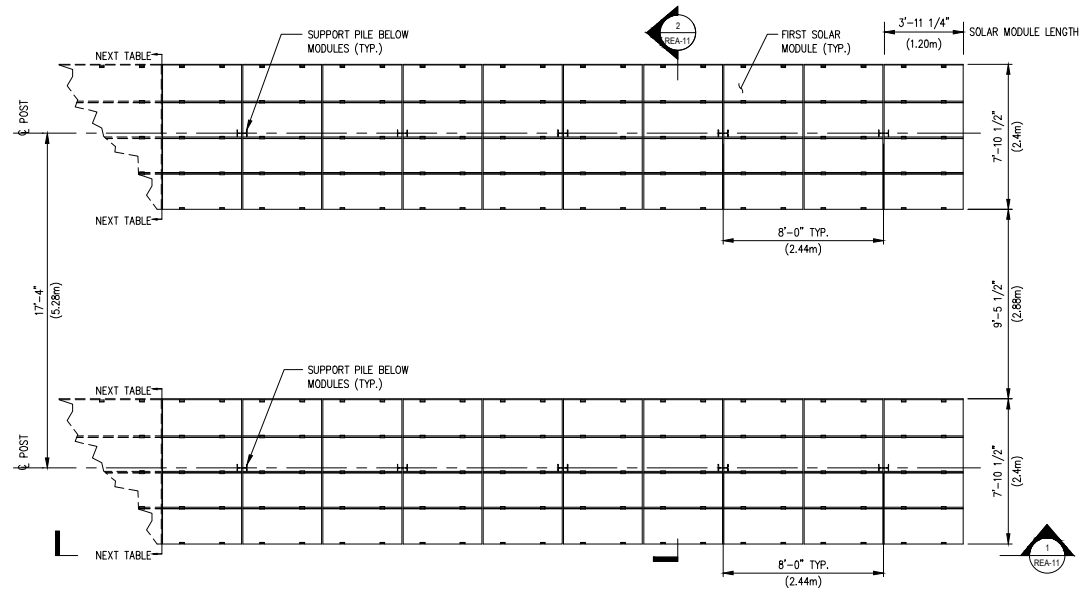
PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: DETAILS & ELEVATIONS

PROJ. MGR. KEITH SYMMERS	PROJ. ENGR. TOM ZACARRIA	DR. BY EH	CHK. BY PC	SCALE: -- -- --	REV.
PROJ. DIRECTOR MARK LANGSON	DRAWING NO. FS ELEC. JOB No: 5028-0102-22	REA-10B			E

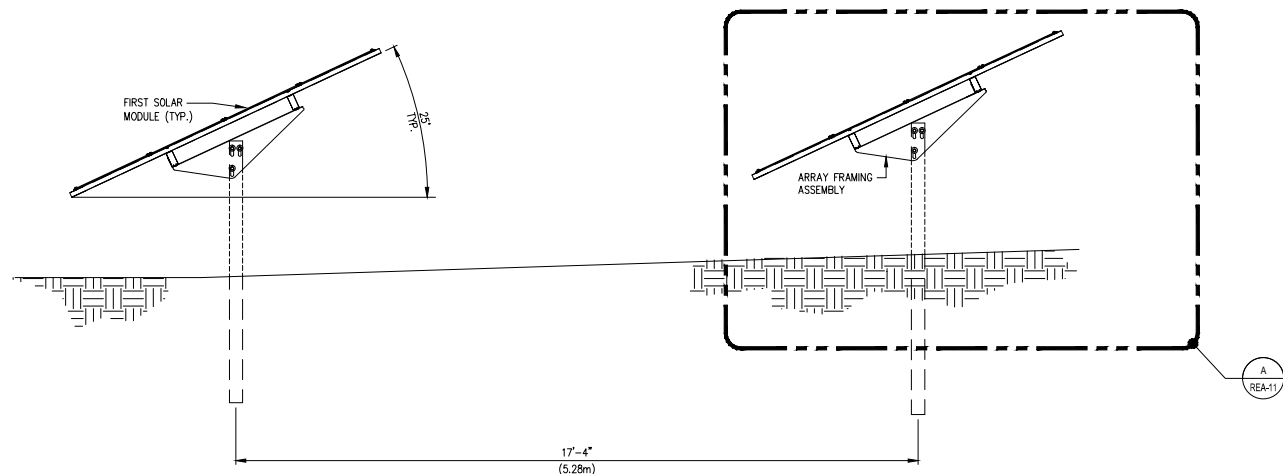
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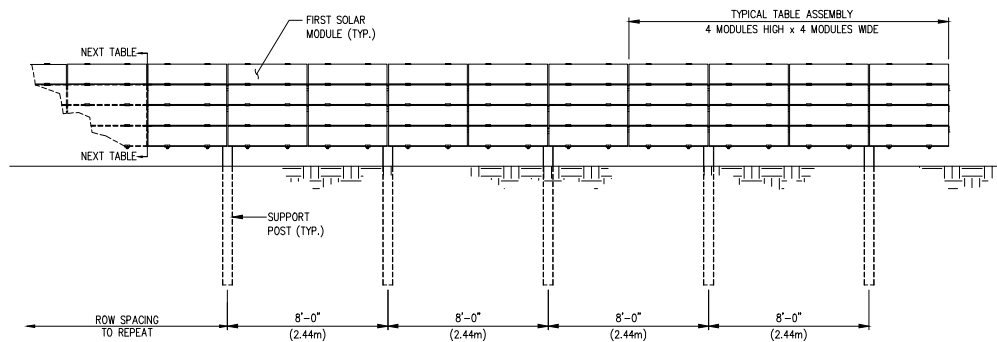


ARRAY PLAN
SCALE: NTS

NOTE:
POSTS ON ARRAY PLAN ARE SHOWN FOR REFERENCE ONLY.

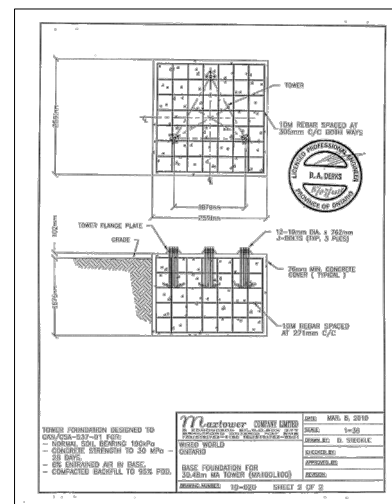
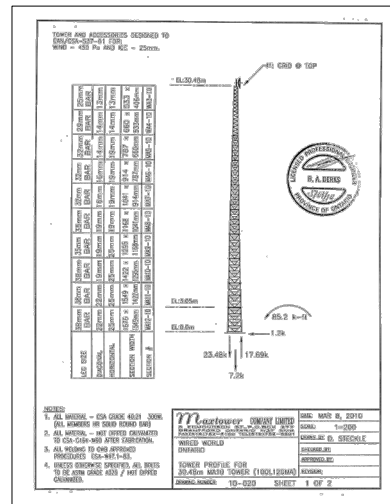


**SIDE VIEW
ARRAY ELEVATION**
2 REA-11 SCALE: NTS

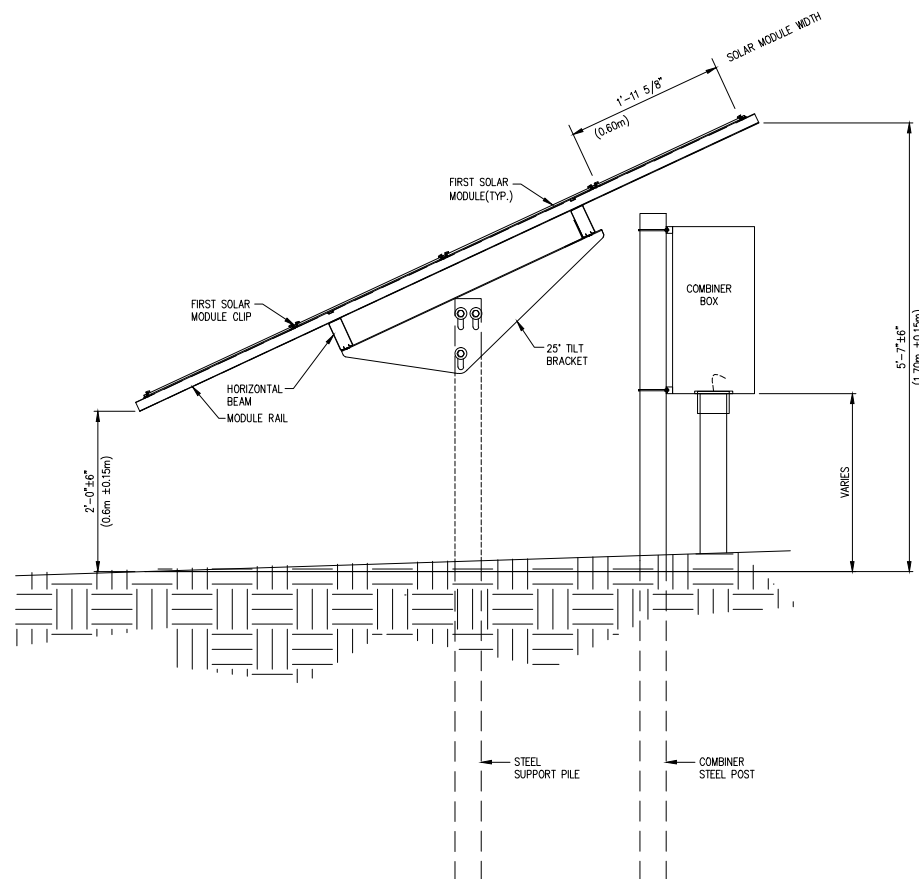


**FRONT VIEW
ARRAY ELEVATION**
1 REA-11 SCALE: NTS


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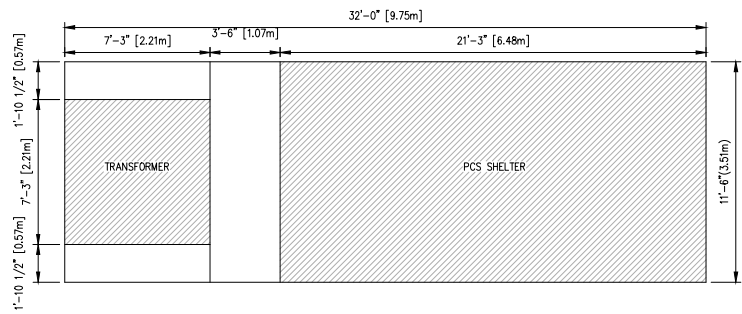


COMMUNICATION TOWER PROFILE AND FOUNDATION DETAIL
SCALE: NTS

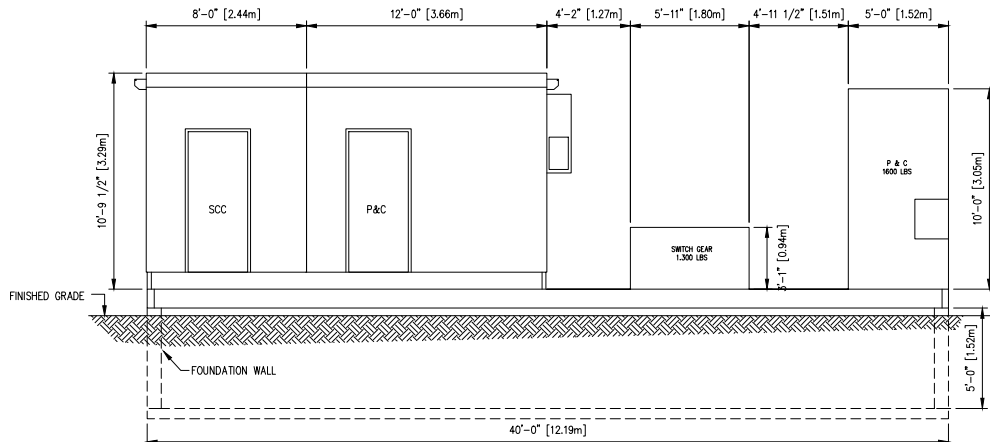


DETAIL
1 REA-11 SCALE: NTS

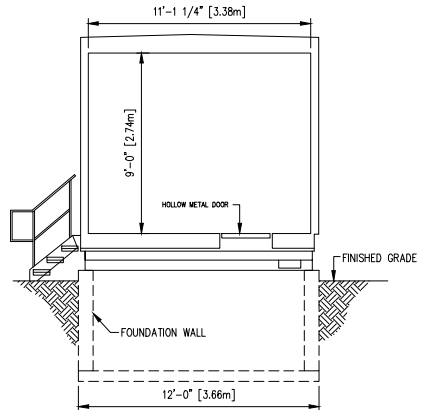
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A	12-09-2009	ISSUED FOR APPROVAL	RAR	MP	TZ
REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
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ST. CLAIR - SOMBRA TOWNSHIP OF ST. CLAIR LAMBTON COUNTY, ONTARIO					
PROJECT: ST. CLAIR - SOMBRA SOLAR FARM					
TITLE: TYPICAL TABLE PLAN, DETAIL AND ELEVATIONS					
PROJ. MGR. KEITH SYMMERS	PROJ. ENGR. TOM ZACCARRIA	DR. BY RAR	CHK. BY MP	SCALE: AS NOTED	REV.
PROJ. DIRECTOR MARK LANGSON	DRAWING NO. FS ELEC. JOB No: 5028-0102-22	REA-11		E	
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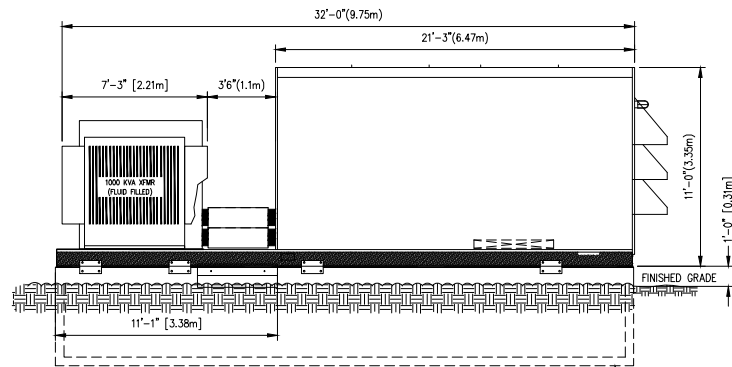
PCS SHELTER PLAN VIEW
SCALE: N.T.S.



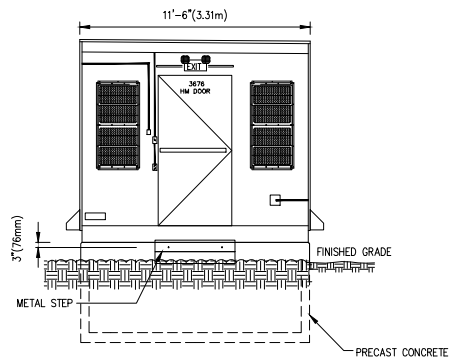
PVIS FRONT ELEVATION
SCALE: N.T.S.



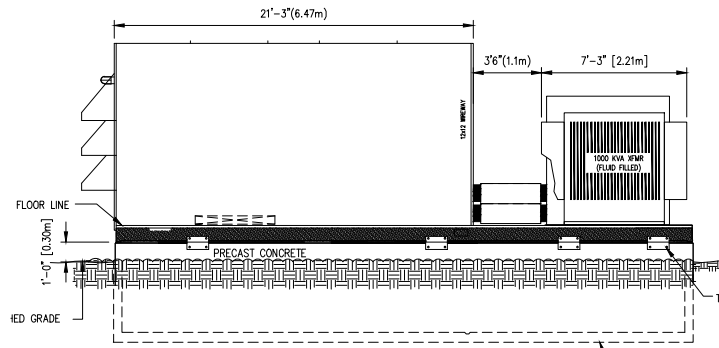
PVIS CROSS SECTION
SCALE: N.T.S.



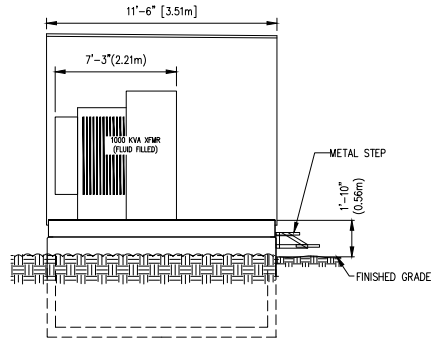
PCS SOUTH ELEVATION
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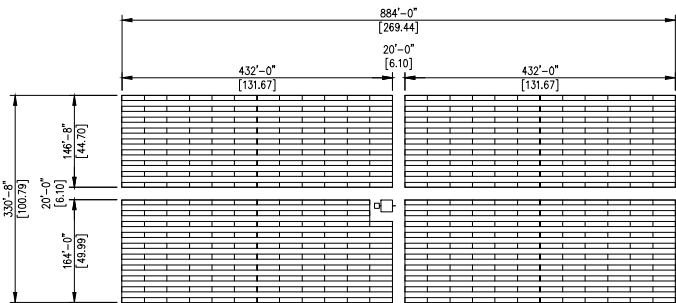
PCS EAST ELEVATION
SCALE: N.T.S.



PCS NORTH ELEVATION
SCALE: N.T.S.

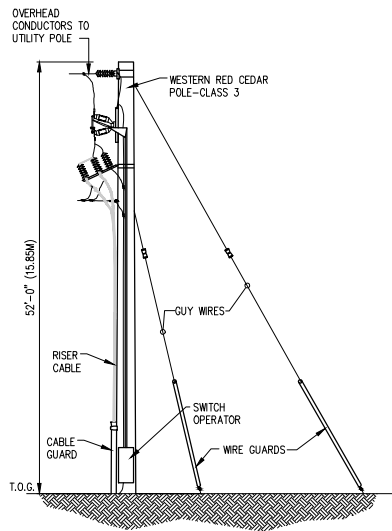


PCS WEST ELEVATION
SCALE: N.T.S.

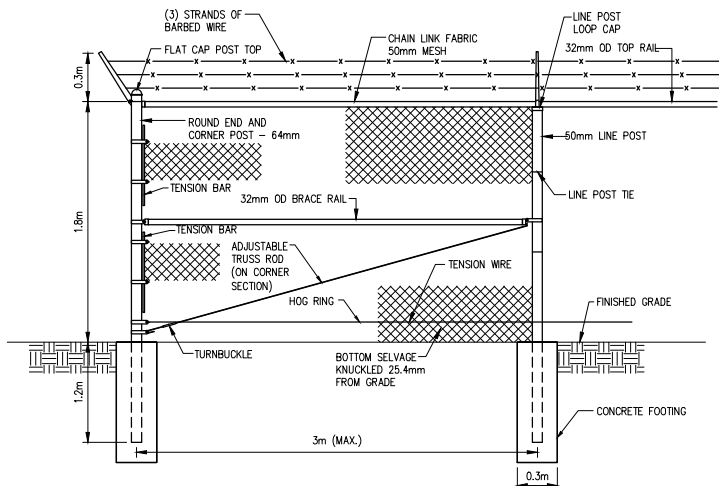


TYPICAL ARRAY LAYOUT
SCALE: N.T.S.

- NOTES:
- 24 ELECTRICAL TABLES PER ROW
 - 75 WATT MODULES SERIES 3
 - 64.8 kWdc/ROW
 - 9 MODULES PER STRING
 - 54 4x4 TABLES
 - 20 ROWS 17'-4" (5.28m) ROW SPACING
 - 1290.6 kW DC/1.0 MW AC
 - 1290.6 DC/AC RATIO



UTILITY RIDER POLE DETAIL
SCALE: N.T.S.



1.83m HIGH CHAIN LINK FENCE
WITH BARBED WIRE TOP
SCALE: N.T.S.

NOTES:

ALL DIMENSIONS ARE APPROXIMATE AND SUBJECT TO FINAL DESIGN.

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SARNIA, ONTARIO, N7T 7Y3

ST. CLAIR - SOMBRA TOWNSHIP OF ST. CLAIR LAMBTON COUNTY, ONTARIO					
PROJECT: ST. CLAIR - SOMBRA SOLAR FARM					
TITLE: PCS SHELTER ELEVATIONS & FOOTPRINTS, PVCS & PVIS EQUIPMENT ARRANGEMENT PLANS AND SECTIONS					
PROJ. MGR. KEITH SYMMERS	PROJ. ENGR. TOM ZACCARRIA	DR. BY MARK LANGSON	CHK. BY MP	SCALE: -- --	REV.
PROJ. DIRECTOR MARK LANGSON		DRAWING NO.		REA-12	
PS ELEC. JOB No. 5028-0102-22				F	
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Appendix B

Equipment Detail/
Specification

First Solar® FS Series 3™ PV Module

MECHANICAL DESCRIPTION

Length	1200mm
Width	600mm
Weight	12kg
Thickness	6.8mm
Area	0.72m ²
Leadwire	4.0mm ² , 610mm
Connectors	Solarline II type connector
Bypass Diode	None
Cell Type	CdS/CdTe semiconductor, 154 active cells
Frame Material	None
Cover Type	3.2mm heat strengthened front glass laminated to 3.2mm tempered back glass
Encapsulation	Laminate material with edge seal

Contact Info:

First Solar (US)	First Solar (Europe)
Tel: +1 (602) 414/9300	Tel: +49 (0) 6131/1443-0
info@firstsolar.com	info@firstsolar.de

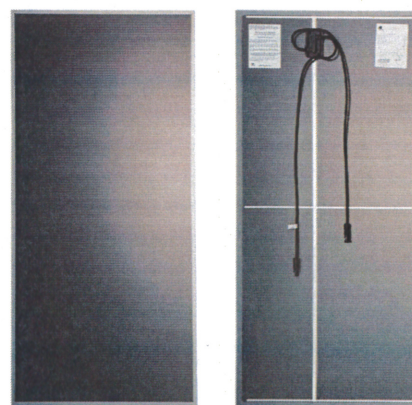


First Solar® FS Series 3™ PV Modules represent the latest advancements in thin film solar module technology. The Series 3 modules are IEC 61646 and IEC 61730 certified for use in systems up to 1000 VDC, UL Listed (600 VDC), and meet the requirements of Safety Class II. First Solar provides cost effective thin film module solutions to leading solar project developers and system integrators for large scale, grid-connected solar power plants. First Solar application engineers provide technical support and comprehensive product documentation to support the design, installation, and long term operations of high performance PV systems.

High Performance PV System Solutions

Key Features:

- Produces high energy output across a wide range of climatic conditions with excellent temperature response coefficient
- Proven to perform as predicted with a high Performance Ratio (PR)
- Frameless laminate is robust, cost-effective and recyclable, and does not require module grounding
- Manufactured in highly automated, state-of-the-art facilities certified to ISO 9001:2008 and ISO 14001:2004 quality and environmental management standards



Warranty:

- Material and workmanship warranty for five (5) years and a power output warranty of 90% of the nominal output power rating ($P_{MPP} \pm 5\%$) during the first ten (10) years and 80% during twenty-five (25) years subject to the warranty terms and conditions.
- Modules are life cycle managed with a collection and recycling program, providing module owners with no cost, prefunded, end-of-life take back, and recycling of the modules.

All specifications and warranties apply only to products sold and installed in North America. For applications in Europe please refer to the EU datasheet (PD-5-401-03 EU).

Electrical Specifications

MODEL NUMBERS AND RATINGS AT STC ¹ *						
Nominal Values		FS-370	FS-372	FS-375	FS-377	FS-380
Nominal Power(+/-5%)	P _{MPP} (W)	70.0	72.5	75.0	77.5	80.0
Voltage at P _{MAX}	V _{MPP} (V)	48.1	49.5	49.8	50.4	50.7
Current at P _{MAX}	I _{MPP} (A)	1.46	1.46	1.51	1.54	1.58
Open Circuit Voltage	V _{OC} (V)	60.6	61.4	61.6	61.7	61.7
Short Circuit Current	I _{SC} (A)	1.74	1.75	1.76	1.75	1.76
Maximum System Voltage	V _{sys} (V)	1000 (600 UL ²)				
Temperature Coefficient of P _{MPP}	T _K (P _{MPP})	-0.25%/°C				
Temperature Coefficient of V _{OC} , high temp (>25°C)	T _K (V _{OC} , high temp)	-0.27%/°C				
Temperature Coefficient of V _{OC} , low temp (-40°C to + 25°C)	T _K (V _{OC} , low temp)	-0.20%/°C				
Temperature Coefficient of I _{SC}	T _K (I _{SC})	+0.04%/°C				
Limiting Reverse Current	I _R (A)	3.5				
Maximum Series Fuse	I _{CF} (A)	3.5				

MODEL NUMBERS AND RATINGS AT 800W/m ² , 45°C, AM 1.5*						
Nominal Values		FS-370	FS-372	FS-375	FS-377	FS-380
Nominal Power(+/-5%)	P _{MPP} (W)	52.5	54.4	56.3	58.1	60.0
Voltage at P _{MAX}	V _{MPP} (V)	45	46	47	47	47
Current at P _{MAX}	I _{MPP} (A)	1.16	1.17	1.20	1.23	1.26
Open Circuit Voltage	V _{OC} (V)	56	57	57	57	57
Short Circuit Current	I _{SC} (A)	1.43	1.43	1.44	1.44	1.44

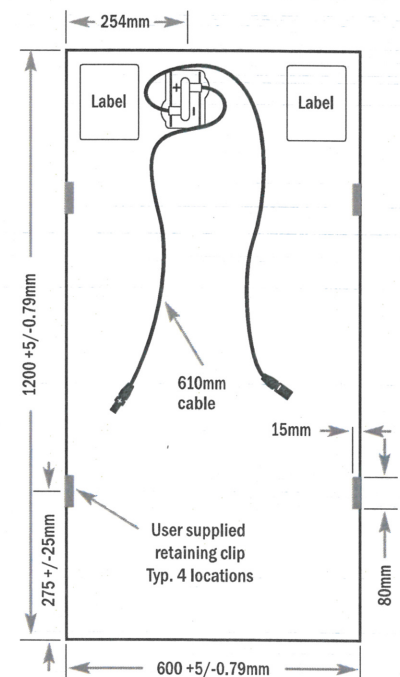
Reliability and Safety

Tested by leading international institutes and certified for reliability and safety.

- Certified to IEC 61646
- Certified to IEC 61730
- CE Mark
- Safety Class II @ 1000 V
- UL 1703 and ULC 1703 Listed (Class C Fire Rating)
- Eligible CSI PV Module
- FSEC Certification



Mechanical Drawing



* All ratings +/-10%, unless specified otherwise. Specifications are subject to change.

¹ Standard Test Conditions (STC) 1000W/m², AM 1.5, 25°C

² Required to maintain UL compliance

About First Solar

First Solar is a leading manufacturer of photovoltaic (PV) solar modules and provider of solar solutions. By continually driving down manufacturing costs, First Solar is delivering an economically viable alternative to fossil-fuel generation. From raw material sourcing through end-of-life collection and recycling, First Solar is focused on creating cost-effective, renewable energy solutions that protect and enhance the environment. Currently, First Solar operates facilities in the US, Malaysia, and Germany.



SUNNY CENTRAL 500HEUS



- 98% peak efficiency*
- Couples to medium voltage external transformer

- Graphical LCD interface
- Sunny WebBox, Modbus® & OPC compatible

- Optional combiner boxes with string monitoring
- Optional DC & AC disconnects
- UL 1741 / IEEE-1547 certified**

SUNNY CENTRAL 500HEUS

The ideal inverter for large scale PV power systems

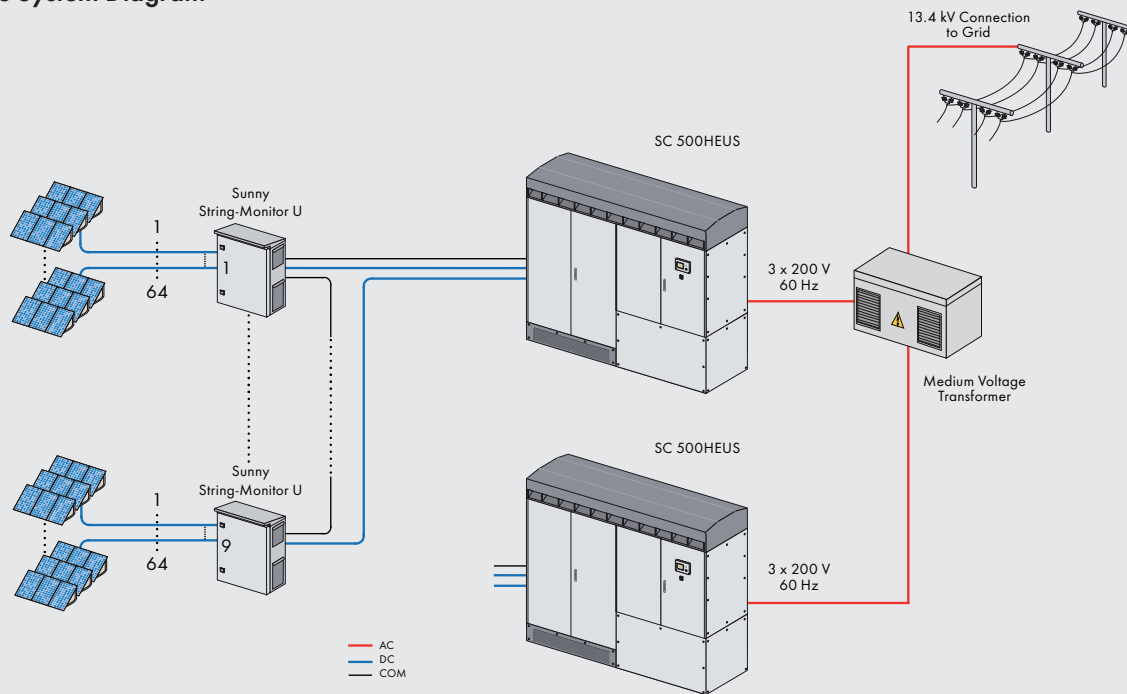
The new Sunny Central 500HEUS couples to an external medium voltage transformer to accommodate long distance power feeds to distribution substations and delivers the highest efficiency available for large PV inverters. An updated user interface features a large LCD that provides a graphical view of the daily plant production as well as the status of the inverter and the utility grid. With the optional Sunny WebBox, users can now choose from either RS485 or Ethernet based communications. Designed for easy installation, operation and performance monitoring, the new SC 500HEUS is the ideal choice for your large scale PV project.

*Preliminary data **Pending

Technical Data

	Sunny Central 500HEUS
Inverter Technology	True sine wave, high frequency PWM
AC Power Output	500 kW
AC Voltage	200 V (range 180 – 220 V)
AC Frequency	60 Hz
Current THD	< 5%
Power Factor at Nominal Power	> 0.99
AC Output Current Limit	1470 A at 200 V
DC Input Voltage Range	300 – 600 V _{DC}
MPP Tracking	300 – 600 V _{DC}
PV Start Voltage (Configurable from 300 – 600 V _{DC})	300 V _{DC}
Maximum DC Current	1600 A _{DC}
Peak Efficiency*	98%
CEC Weighted Efficiency*	97.5%
Power Consumption	<180 W Standby, <1600 W with fans
Ambient Operating Temperature	–13 to 113 °F at full power output up to 122 °F at reduced power
Cooling	Variable-speed forced air (temperature controlled)
Enclosure	NEMA 3R
Dimensions: W x H x D in inches	98 x 90 x 35
Weight	3970 lbs
Certification**	UL 1741, IEEE-1547
*Preliminary data	
**Pending	
Type designation	SC 500HEUS

Sample System Diagram



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SMA America, LLC

Combiner Box Detail

First Solar's photovoltaic power generation facility is generally combined with several 1MW arrays to compile an nMW system size. Each array is electrically isolated from the rest. The solar modules are tied together in series to make a maximum system voltage, and strung in parallel to combine currents. Harnesses are used to combine currents into circuits no larger than 30 amps for connector rated reasons, however circuits are then combined using 'Combiner Boxes' (junction boxes) in another parallel configuration. These junction boxes can be rated anywhere between 200 and 400 amps. The combiner box has a DIN rail mounted series of fuses to protect the positive harness circuits. The other end of the fuses are tied together using a Bus Bar with a comb configuration to terminate each fuse. The fuses are then in parallel, and the currents combine to a range between 200 and 400 amps, short circuit. A lug on the busbar allows for a cable termination large enough to sustain the short circuit current between the combiner box and the inverter (which again gets fused on the input side). The negative electrodes of all circuits are paralleled in a distribution block, but are not fused. All the combiner box outputs meet at the PCS shelter to be terminated at another overcurrent protection device, before meeting the input of the inverter. The combiner boxes are strategically placed in the 1MW array in order to compensate voltage drop from cable resistance, as well as system ampacity from parallel combined circuits. All combiner boxes have a DC disconnect switch for monitoring and maintenance safety purposes.

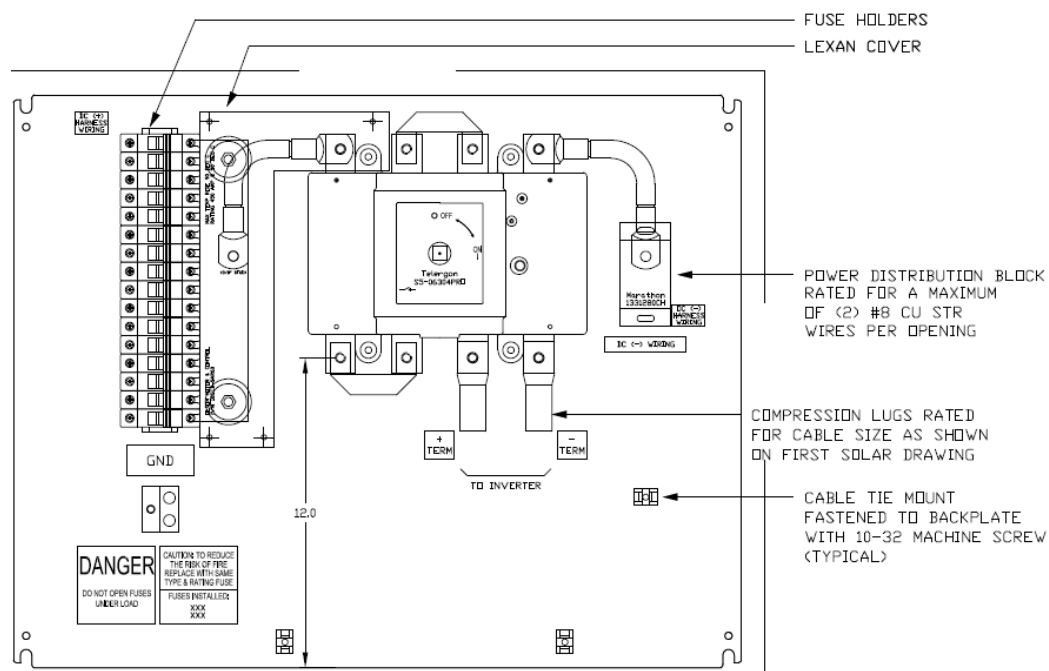
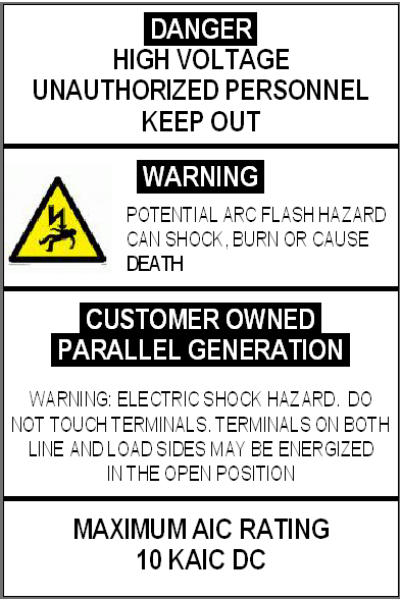
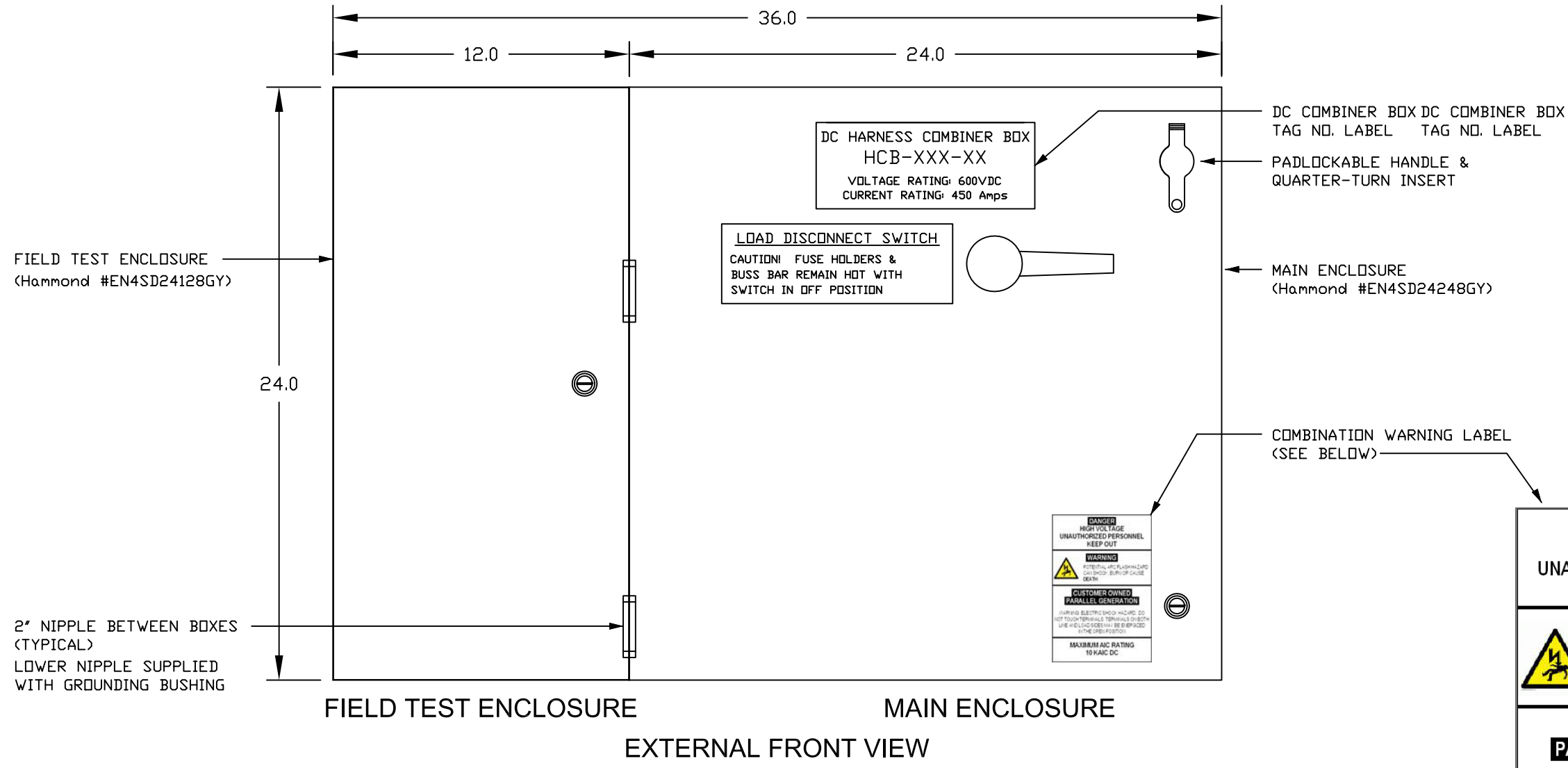


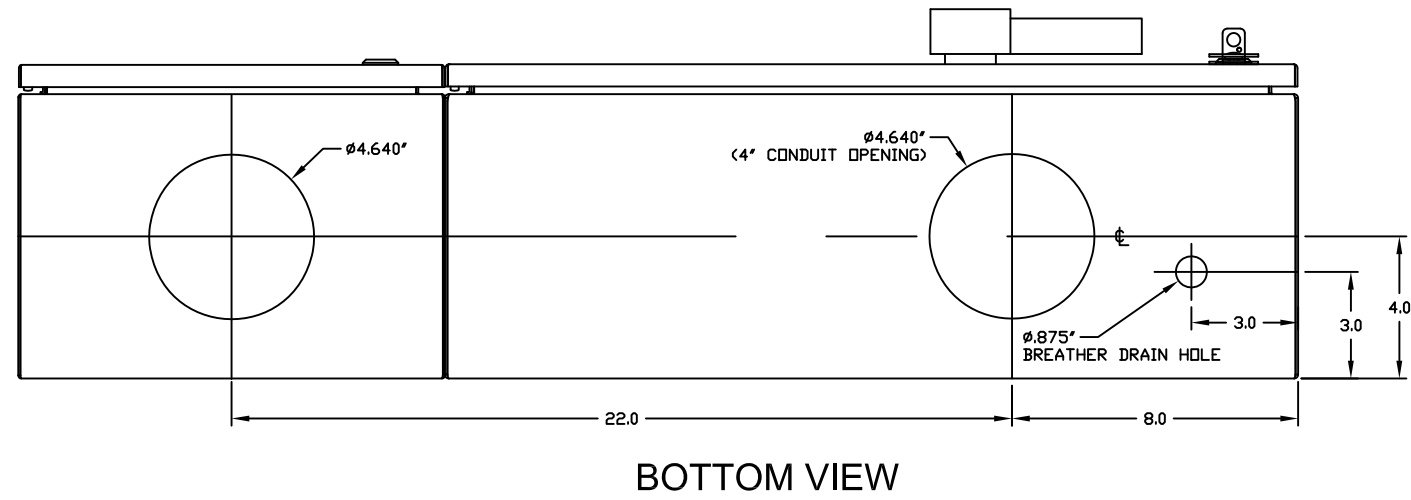
Figure 1: Typical 400A combiner box layout

Typical Combiner Box BOM:

- | | |
|----------------------|-----------------------|
| • Enclosure | • Quarter Turn Insert |
| • Padlockable Handle | • Test Enclosure |
| • 400A Disconnect | • Test Backplate |
| • Fuses | • Main Enclosure |
| • Fuse Holders | • Main Backplate |
| • Ground Lug | • Conduit |
| • Bus Bar | • Locknut |
| • Compression Lug | • Bushing |
| • Cable Tie Mount | • Grounding Bushing |
| • Breather/Drain | |



DC COMBINER BOX



NOTES:

1. DOOR LABELS TO BE WEATHER-RESISTANT VINYL.

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OLSON MOTOR & CONTROL CO., INC
1215 KENNEDY BLVD
MANVILLE, NJ 08835

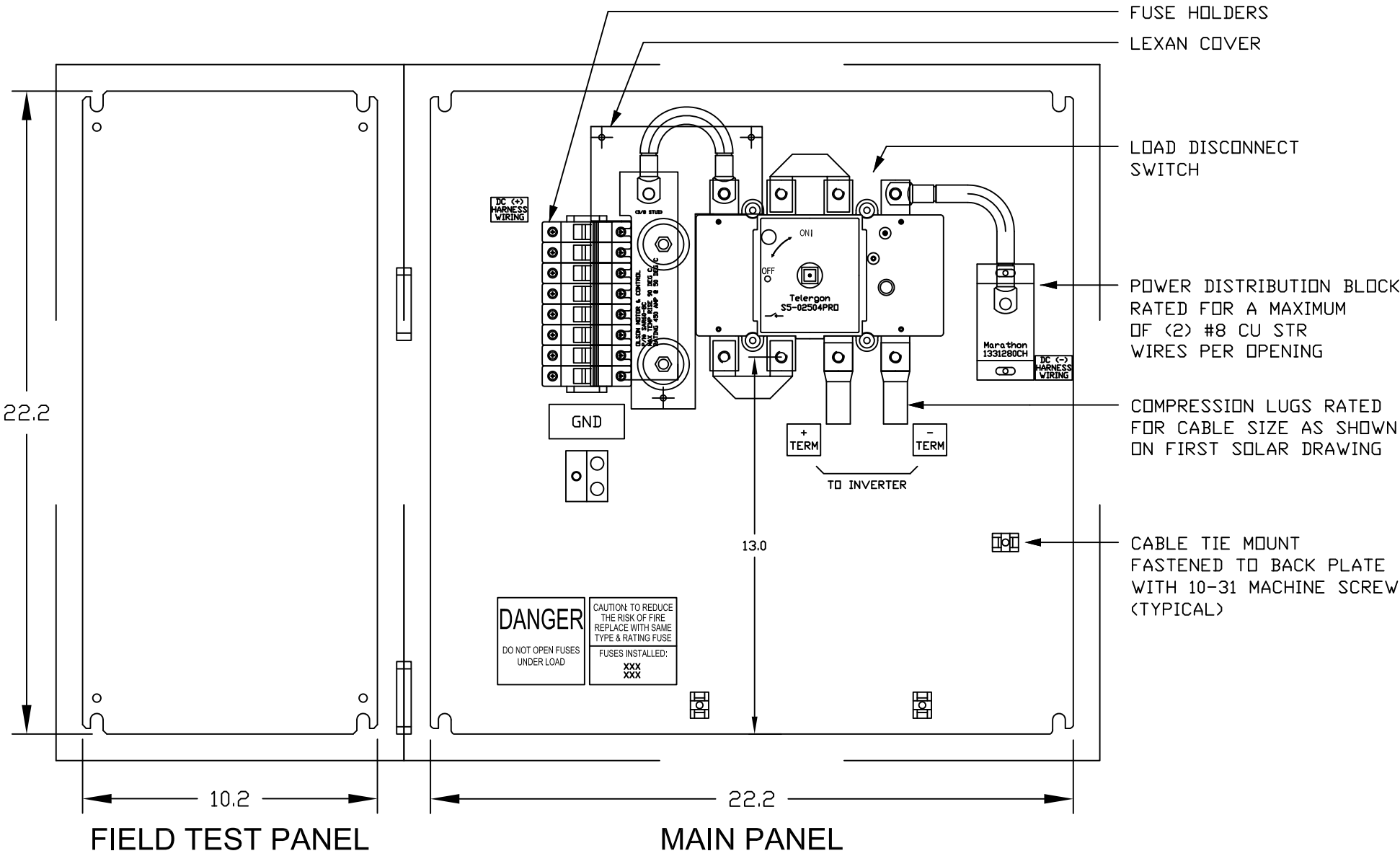
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BY: MO	DATE: 03/22/10	DWG NUMBER
REV: 1	SHT 2 OF 2	(See Above)

Dwg: Sarnia60CombBoxLoadNfDiscSideBox8C_200A.dwg

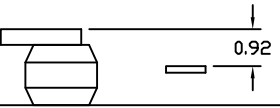
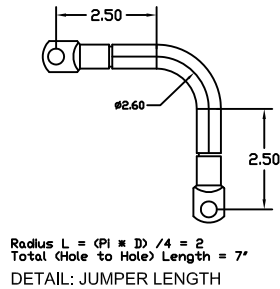
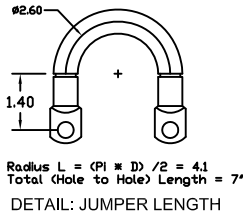
NOTES:

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INTERNAL LAYOUT

DC COMBINER BOX



Dwg: Sarnia60CombBoxLoadNfDiscSideBox8C_200A.dwg

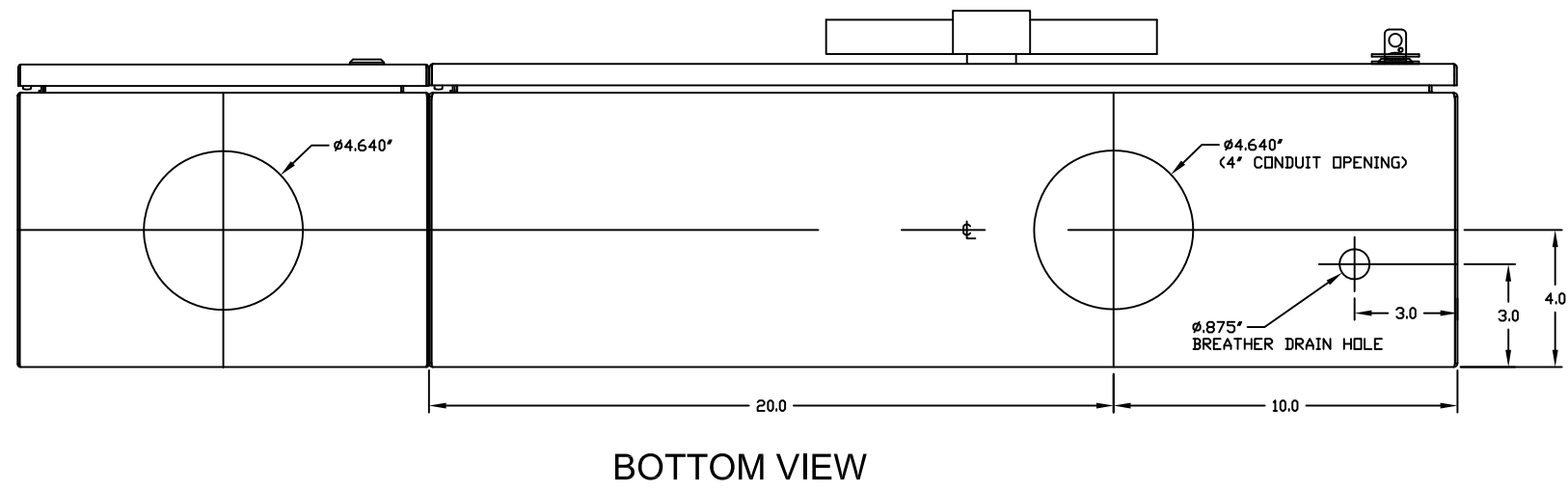
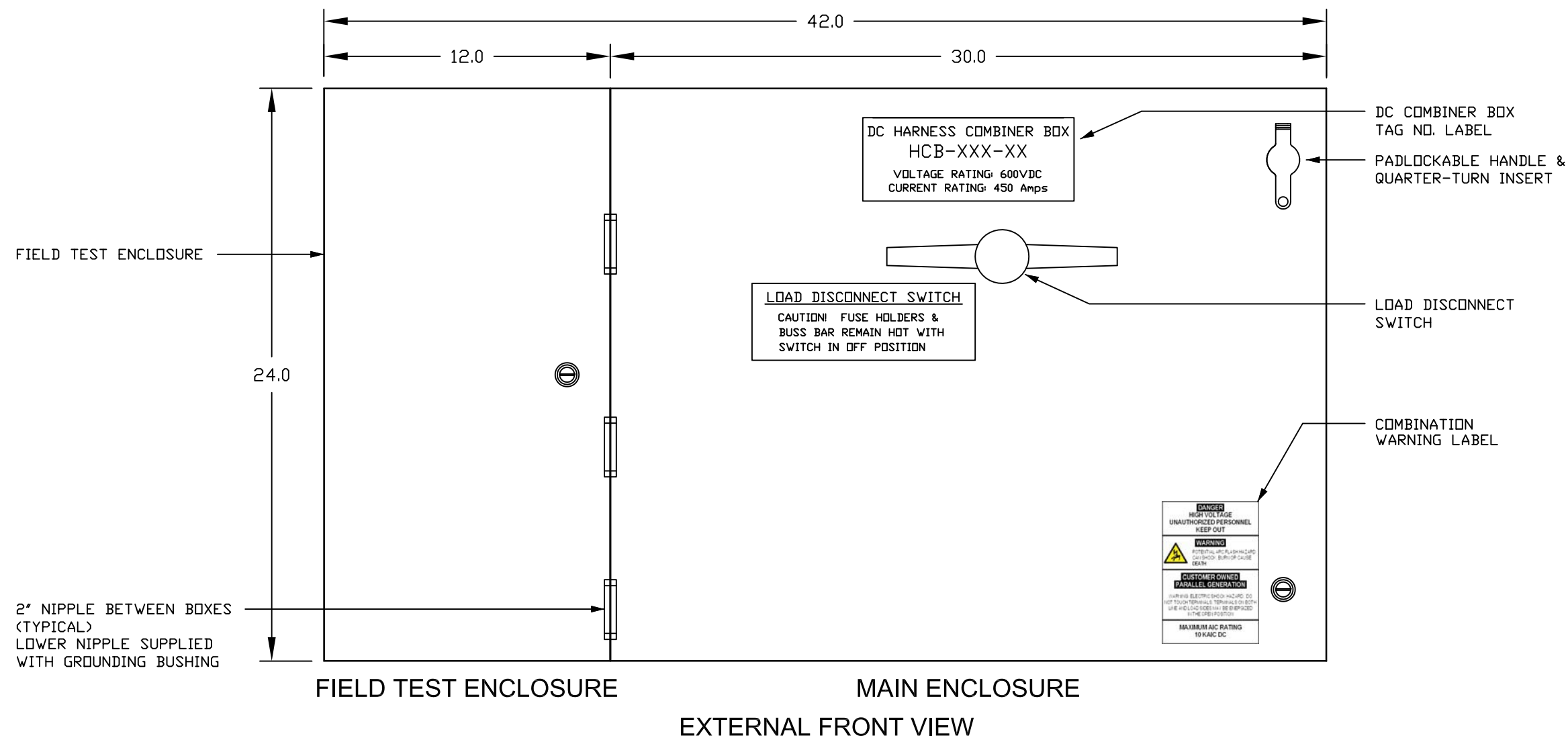
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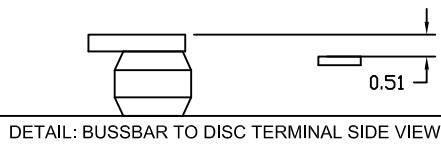
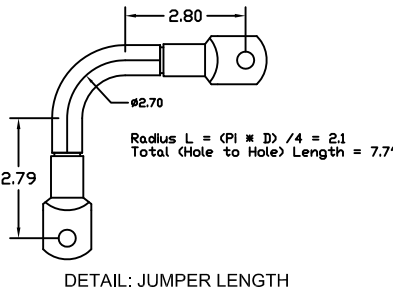
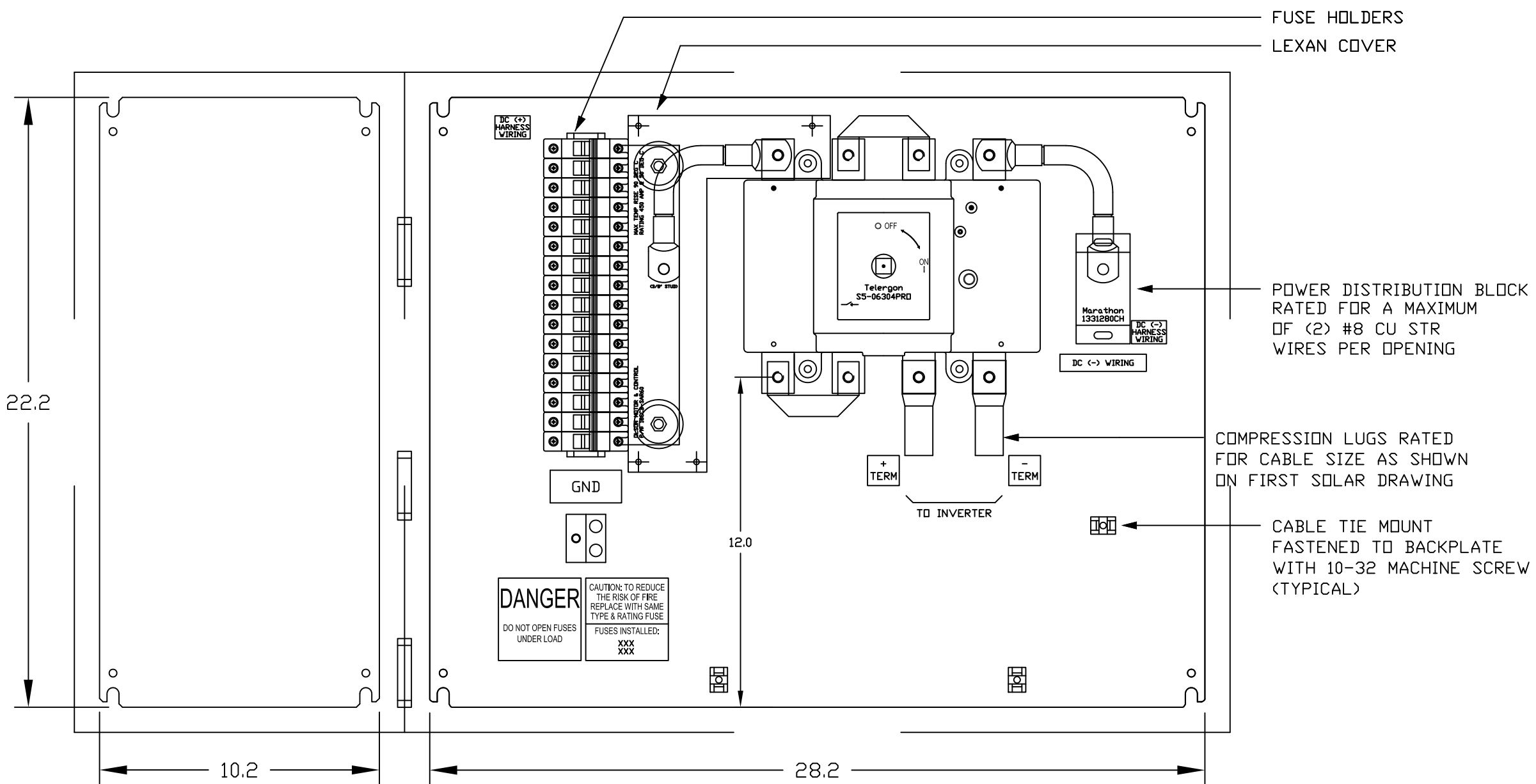
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MANVILLE, NJ 08835

Dwg: Sarnia60CombBoxLoadNfDiscSideBox16C_400A.dwg

TITLE: FIRST SOLAR SARNIA 60 COMBINER BOX, 16C, 400A, 600V, LOAD NF DISCONNECT, SIDE BOX, GROUNDED		
BY: MO	DATE: 03/20/10	DWG NUMBER
REV:	SHT 2 OF 2	(See Above)

NOTES:
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Three-Phase Pad-mounted Compartmental Type

Electrical Apparatus
210-12

GENERAL

Cooper Power Systems three-phase pad-mounted compartmental type distribution transformers are designed to withstand all environmental hazards. The transformers are designed to meet or exceed all applicable ANSI, NEMA, IEEE standards, and NEC® and CEA specifications.

All transformers are newly manufactured and are produced expressly to meet exacting customer specifications. Many configurations and accessories are available to meet a wide range of application demands. Transformers from stock are available for any emergency situations that may arise.

Cooper Power Systems three-phase pad-mounted transformers are available in live-front or dead-front designs. Cooper has proven field service with pad-mounted transformers rated 45-7500 kVA, and high-voltage ratings from 2400 volts up to 46,000 volts. Designs offered include; delta and wye configurations, with single- or series-multiple combinations with either taps (for de-energized operation), or no-taps. Step-down designs are also available.

Both radial and loop feed configurations are built to ANSI standards. The dead-front bushing configurations are in accordance with ANSI C57.12.26, live-front per ANSI C57.12.22.

Cooper Power Systems transformers are built to exceed ANSI C57.12.28 for tamper resistance and for corrosion resistance. Each transformer is painted using our state-of-the-art painting system which includes eight pretreatment stages and seven coating and curing processes.

Transformer cores are manufactured from the highest quality grain oriented silicon core steel. Unlike amorphous metal cores, silicon core steel is less susceptible to ferroresonance and exhibits increasingly greater efficiency above 50% loading. Rectangular wound core construction is used offering lower losses, low excitation current, and quiet operation. Rectangular stacked core designs are available for 1500 kVA and above.



Figure 1.
Three-phase pad-mounted transformer.

The best reason to choose Cooper Power Systems three-phase transformers is that they have the lowest failure rate in the industry.

STANDARD CONNECTIONS & NEUTRAL CONFIGURATIONS

- **Delta - Wye:** For Delta-Wye configurations the low voltage neutral shall be a fully insulated X_0 bushing with a removable ground strap.
- **Grounded Wye-Wye:** For Grounded Wye-Wye configurations the high voltage neutral shall be internally tied to the low voltage neutral and brought out as the H_0X_0 bushing in the secondary compartment with a removable ground strap.
- **Delta-Delta:** For Delta-Delta configurations the transformer shall be provided without a neutral bushing.
- **Wye-Wye:** For Wye-Wye configurations the high voltage neutral shall be brought out as the H_0 bushing in the primary compartment and the low voltage neutral shall be brought out as the X_0 bushing in the secondary compartment.
- **Wye-Delta:** For Wye-Delta configurations the high voltage neutral shall be brought out as the H_0 bushing in the primary compartment. No ground strap shall be provided (line to line rated fusing is required).

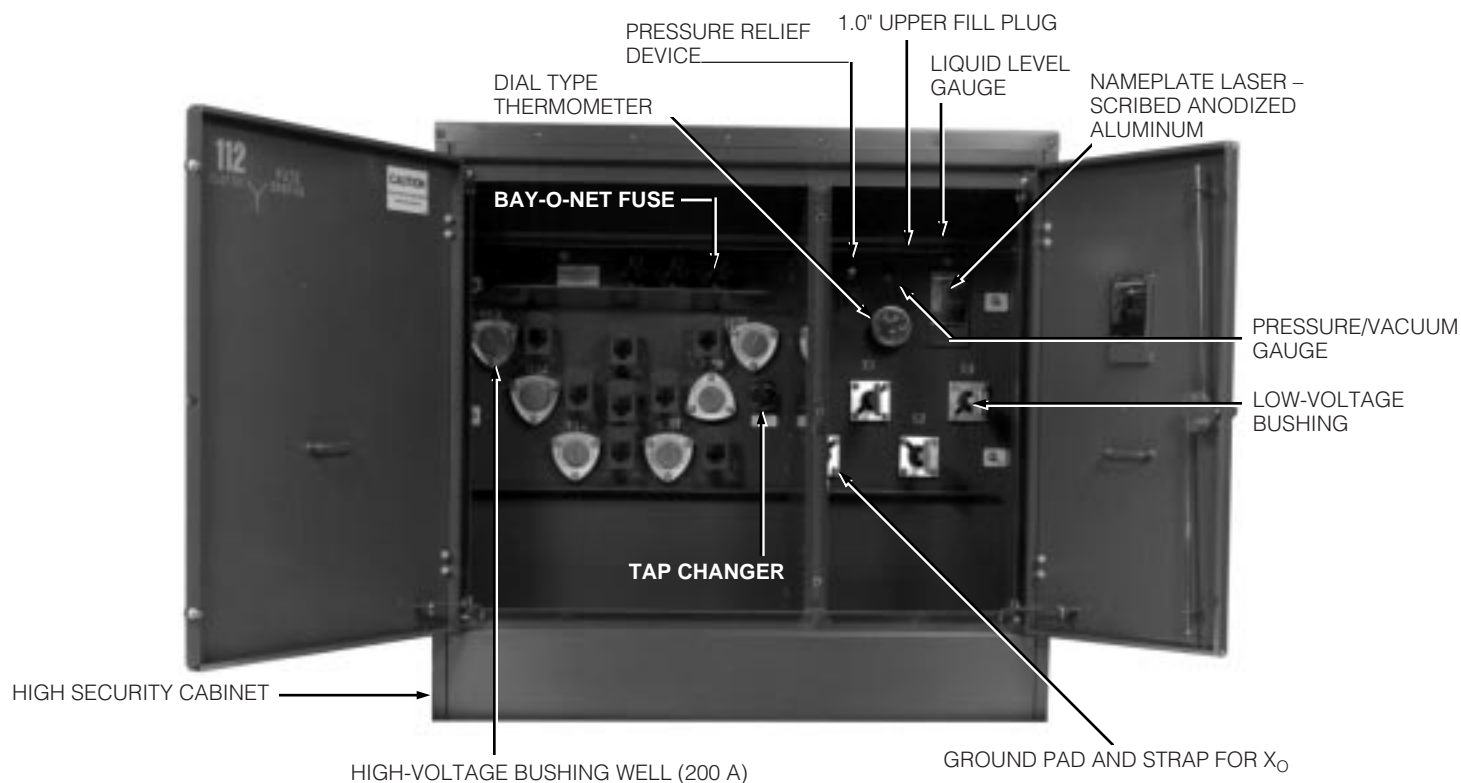


Figure 2.
Three-phase pad-mounted compartmental type transformer.

STANDARD FEATURES

- Bolted cover for tank access (45-1000 kVA)
- Welded cover with handhole (1500-7500 kVA)
- Three-point latching door for security
- Lightning arrester mounting provisions (live-front)
- Laser-scribed anodized aluminum nameplate
- One-inch drain valve with sampling device in low-voltage compartment (45-7500 kVA)
- One-inch upper fill plug
- Automatic pressure relief device
- 20" Deep cabinet (45-1000 kVA)
- 24" Deep cabinet (1500-7500 kVA)
- 30" Deep cabinet (34.5/19.92 kV)
- Removable sill for easy installation
- Steel divider between high-voltage and low-voltage compartments
- RTE® (15, 25 kV) 200 A (HTN) bushing wells
- RTE (15, 25, 35 kV) 200 A Integral bushings (dead-front)
- Cooper electrical-grade wet-process porcelain bushings (live-front)

- Lifting lugs (4)
- Stainless steel ground pads (45-500 kVA)
- Stainless steel NEMA 2-hole ground pads (750-7500 kVA)
- Stainless steel cabinet hinges & mounting studs

OPTIONAL ACCESSORIES

- Liquid level gauge
- Pressure vacuum gauge
- Dial type thermometer
- R-Temp® less-flammable fluid and other environmentally desirable fluid options
- One, two, or three On/Off loadbreak switches
- 4-position loadbreak switch – V-blade switch, T-blade switch
- Low-voltage 6-, 8-, 10-hole spade
- Low-voltage 12-, 16-, 20-hole spade (750-2500 kVA)
- Low-voltage bushing supports
- RTE (15, 25 kV) high-voltage 200 A bushing inserts
- RTE (15, 25 kV) high-voltage 200 A feedthru inserts
- RTE (15, 25 kV) high-voltage 200 A (HTN) bushing wells with removable studs

- RTE (15, 25, 35 kV) high-voltage 600 A deadbreak one-piece bushings
- Hexhead captive bolt
- High-voltage warning signs
- Ground connectors
- Drain/sampling valve in high-voltage compartment
- Breaker mounting provisions
- Touch-up paint
- Stainless steel nameplate
- Stainless steel tank base & cabinet
- Stainless steel tank base & cabinet sides and sill
- Service entrance (2 inch) in sill or cabinet side
- Nitrogen blanket with bleeder and purge valve
- Delta-wye switch
- Auxiliary contacts for liquid level gauge
- Auxiliary contacts for dial type thermometer
- All copper windings
- Globe type upper fill valve
- Kyle® Vacuum Fault Interrupter (VFI)
- K-Factor transformer
- Factory Mutual approved transformer

TABLE 1
Three-Phase Ratings

Three-Phase 50 or 60Hz 65°C, or 55/65°C Rise	
kVA Available	
45	1000
75	1500
112.5	2000
150	2500
225	3000
300	3750
500	5000
750	7500

TABLE 2
Percent Impedance Voltage

kVA Rating	Low-Voltage Rating					
	≤150 kV BIL		200 kV BIL		250 kV BIL	
	≤600 V	>600 V	≤600 V	>600 V	≤600 V	>600 V
45-75	1.00-5.00	—	7.25	—	7.75	—
112.5-300	1.20-6.0	5.5	7.25	7.0	7.75	7.5
500	1.50-7.00	5.5	7.25	7.0	7.75	7.5
750-2500	5.75	5.5	7.25	7.0	7.75	7.5
3000-5000	5.75	5.5	7.25	7.0	7.75	7.5
7500	—	6.5	7.25	7.0	7.75	7.5

TABLE 3
Low-Voltage Ratings

208Y/120
240 Delta
240 Delta with 120 Midtap
480Y/277
480 Delta
600Y/347
Other Voltages Under 600V
Other Voltages with 45 kV, 60 kV, 75 kV and 95 kV BIL are also available ¹

¹ See Table 5 for ranges of KVA's with secondaries greater than 600 volts.

TABLE 4
Range of kVA and Voltage Ratings

High-Voltage Ratings (Volts)	KVA Rating		
	Low-Voltage Ratings (Volts) 208Y/120, 240	Low-Voltage Ratings (Volts) 480Y/277, 480, 600Y/347	Low-Voltage Ratings (Volts) >600
Delta or Wye			
2400	45-750	45-750	300-750
4160	45-1000	45-1000	300-1000
4800	45-1000	45-1500	300-1500
7200	45-1000	45-2000	300-2000
12,000, 12,470	45-1000	45-3750	300-7500
13,200, 13,800, 16,340	45-1000	45-3750	300-7500
22,860, 23,900, 24,940	45-1000	45-3750	300-7500
34,500	75-1000	75-3750	300-7500
Wye			
43,800	1000	1000-3750	1000-7500

TABLE 5
High-Voltage and BIL²

Transformer		Electrical Characteristics of the Completely Assembled High-Voltage Connectors		
		High-Voltage Rating	BIL (kV)	60-Hz Dry One Minute Withstand (kV)
High-Voltage Ratings (Volts)	Minimum BIL (kV)	Phase-to-Ground /Phase-to-Phase (kV)		
Single High-Voltage				
2400	60	8.3/14.4	95	34
4160	60	8.3/14.4	95	34
4800	60	8.3/14.4	95	34
7200	75	8.3/14.4	95	34
12000	95	8.3/14.4	95	34
12470	95	8.3/14.4	95	34
13200	95	8.3/14.4	95	34
13800	95	8.3/14.4	95	34
14400	95	8.3/14.4	95	34
16430	95	8.3/14.4	95	34
22920	125	15.2/26.3	125	40
26400	150	See note ³	See note ³	See note ³
34400	200	See note ³	See note ³	See note ³
34500	200	See note ³	See note ³	See note ³
43800	250	See note ³	See note ³	See note ³
4160GrdY/2400	60	8.3/14.4	95	34
8320GrdY/4800	75	8.3/14.4	95	34
12470GrdY/7200	95	8.3/14.4	95	34
13200GrdY/7620	95	8.3/14.4	95	34
13800GrdY/7970	95	8.3/14.4	95	34
22860GrdY/13200	125	15.2/26.3	125	40
23900GrdY/13800	125	15.2/26.3	125	40
24940GrdY/14400	125	15.2/26.3	125	40
34500GrdY/19920	150	21.1/36.6	150	50
Series Multiple High-Voltage				
4160GrdY/2400 x 12470GrdY/7200	60 x 95	8.3/14.4	95	34
4160GrdY/2400 x 13200GrdY/7620	60 x 95	8.3/14.4	95	34
4800 x 13200GrdY/7620	60 x 95	8.3/14.4	95	34
8320GrdY/4800 x 24940GrdY/14400	75 x 125	15.2/26.3	125	40
12470GrdY/7200 x 24940GrdY/14400	95 x 125	15.2/26.3	125	40
13200GrdY/7620 x 24940GrdY/14400	95 x 125	15.2/26.3	125	40
23900GrdY/13800 x 34500GrdY/19920	125 x 150	21.1/36.6	150	50

² Transformers are available in the standard ratings and configurations shown or can be customized to meet specific needs.

³ Contact Cooper Power Systems for high-voltage connector information.

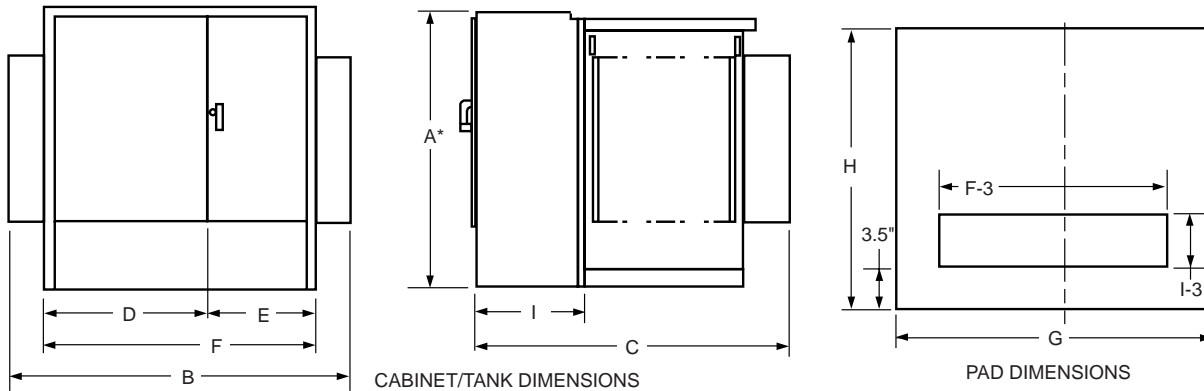


Figure 3.
Transformer and Pad dimensions.

* Add 9" for Bay-O-Net fusing.

TABLE 6
Typical Dimensions and Weights³

65°C Rise	DEAD-FRONT - LOOP OR RADIAL FEED - BAY-O-NET FUSING¹ OIL FILLED -ALUMINUM WINDINGS										
kVA Rating	OUTLINE DIMENSIONS (in.)									Gallons Of Fluid	Approx. Total Weight (lbs.)
	A¹	B	C	D	E	F	G	H	I		
45	50	68	39	42	26	68	72	43	20	150	2600
75	50	68	39	42	26	68	72	43	20	160	2800
112.5	50	68	49	42	26	68	72	53	20	165	2900
150	50	68	49	42	26	68	72	53	20	170	3350
225	50	72	51	42	30	72	76	55	20	180	3800
300	50	72	51	42	30	72	76	55	20	190	4450
500²	50	89	53	42	30	72	93	57	20	240	5700
750²	64	89	57	42	30	72	93	61	20	380	8200
1000²	64	89	59	42	30	72	93	63	20	480	10,100
1500²	73	89	86	42	30	72	93	90	24	570	13,950
2000²	73	72	87	42	30	72	76	91	24	640	15,000
2500²	73	72	99	42	30	72	76	103	24	760	18,850
3000²	73	84	99	46	37	84	88	103	24	780	19,000
3750²	84	85	108	47	38	85	88	112	24	800	19,500
5000²	84	96	108	48	48	96	100	112	24	930	29,400
7500²	94	102	122	54	48	102	100	126	24	1580	41,900

TABLE 7
Typical Dimensions and Weights³

65°C Rise	LIVE-FRONT - LOOP OR RADIAL FEED - BAY-O-NET FUSING' OIL FILLED -ALUMINUM WINDINGS										
kVA Rating	OUTLINE DIMENSIONS (in.)									Gallons Of Fluid	Approx. Total Weight (lbs.)
	A¹	B	C	D	E	F	G	H	I		
45	50	64	39	34	30	64	69	43	20	150	2600
75	50	64	39	34	30	64	69	43	20	160	2800
112.5	50	64	49	34	30	64	69	53	20	165	2900
150	50	64	49	34	30	64	69	53	20	170	3350
225	50	64	51	34	30	64	73	55	20	180	3800
300	50	64	51	34	30	64	75	55	20	190	4450
500²	50	81	53	34	30	64	85	57	20	240	5700
750²	64	89	57	42	30	72	93	61	20	380	8200
1000²	64	89	59	42	30	72	93	63	20	480	10,100
1500²	73	89	86	42	30	72	93	90	24	570	13,950
2000²	73	72	87	42	30	72	76	91	24	640	15,000
2500²	73	72	99	42	30	72	76	103	24	760	18,850
3000²	73	84	99	46	37	84	88	103	24	780	19,000
3750²	84	85	108	47	38	85	88	112	24	800	19,500
5000²	84	96	108	48	48	96	100	112	24	930	29,400
7500²	94	102	122	54	48	102	100	126	24	1580	41,900

¹ For fusing with Bay-O-Net only, see Cooper Power Systems catalog section 240-45 or 240-46. (Add 9" to dimension "A" for Bay-O-Net fusing.)

² Available with Kyle Vacuum Fault Interrupter for overcurrent protection. (Minimum height 72" in.)

³ Weights, gallons of fluid and dimensions are for reference only, and not for construction. Please contact Cooper Power Systems for exact dimensions.

CONSTRUCTION

Core

High efficiency rectangular wound core design offers low excitation current, low losses, and quiet performance. Cores are manufactured in either five-leg or triplex configurations from precision-cut single-turn laminations of high quality, grain oriented silicon core steel. Fully annealed after cutting and forming the lamination joints are precisely stacked, virtually eliminating gaps in the corner joints. These cores are less susceptible to ferroresonance and exhibit lower losses above 50% loading than amorphous cores. Stacked core designs are also available.

Coil

The coils are made compact, rigid, mechanically strong, and electrically balanced with impedances in accordance with ANSI C57.12.26. The wound coils are hydraulically pressed to squeeze the wire and interlayered paper tightly together, then baked to bond the windings into a solid compact coil with excellent dielectric and certified short-circuit strength when tested to ANSI C57.12.90. Extra mechanical strength is provided by diamond pattern, epoxy coated paper insulation, used throughout the coil, with additional adhesive at heavy stress points. The diamond pattern distribution of the epoxy and carefully arranged ducts provide a network of passages through which cooling fluid can freely circulate. The primary coil is manufactured from heavy varnish or paper insulated aluminum or copper wire. Round wire is flattened during winding to provide greater surface contact with the insulating paper and a higher space factor to make a compact, efficient design. The secondary coil is manufactured from full width aluminum strip whose edges are carefully finished to prevent burrs and sharp points, insulated with epoxy-diamond paper between every layer of the conductor. The dielectric insulation levels are per ANSI C57.12.00.

Insulating Fluid

Cooper Power Systems transformers are available with standard electrical grade mineral insulating oil or other dielectric coolants manufactured by Cooper Power Systems. The highly refined oil is tested and degassed to assure a chemically inert product with minimal acid ions. Special additives minimize oxygen absorption and inhibit oxidation. To ensure high dielectric strength, the oil is retested for dryness and dielectric strength,

refiltered, heated, dried, and stored under vacuum before being added to the completed transformer. R-Temp fluid, manufactured by Cooper Power Systems under strict quality control for optimum transformer cooling characteristics, provides higher dielectric strength than mineral oil. The special formulation is less-flammable as defined by the National Electric Safety Code, as well as non-toxic and biodegradable. Envirotemp® FR3 fluid, the fluid used in Envirotran® transformers is a fire resistant, natural ester-based fluid. Envirotemp FR3 fluid offers the advantage of a seed oil-based dielectric coolant with food grade additives, in addition to increased fire safety when compared to mineral oil. R-Temp and Envirotemp FR3 fluid can be used in a pad-mounted transformer next to buildings or inside buildings with suitable containment provisions.

Vacuum Processing

A very low level of moisture is a key factor in the dielectric performance and service life of a transformer. Cooper has paid extensive attention to moisture removal and it has resulted in improved reliability and the industry's longest transformer life expectancy. Cooper's vacuum process simultaneously heats and dries the transformer, removing any moisture in the components.

Circulating current, established by energizing the coils under shorted conditions, heats the coils from the inside. Any moisture turns to a gas which is pulled from the chamber by the vacuum. Once the transformer is thoroughly dried, degassed insulating fluid is added while still under vacuum to assure maximum penetration of the fluid into the coil and insulation, minimizing air pockets that can lead to internal corona failure.

Far superior to hot air dryout systems, Cooper's vacuum processing is carefully controlled to monitor actual residual moisture levels. This contrasts with simple timing according to theoretically calculated process cycle time, which is subject to variations in effectiveness due to environmental and system variances. The process maximizes dielectric strength and virtually eliminates the potential for insulation damage.

Tank

Tanks are formed of precision cut cold-rolled steel. Tank bases are constructed to permit rolling in any direction perpendicular to a tank wall. Heavy-duty lifting hooks and jack pads are provided. All tanks are pressure tested to withstand 7 psig without permanent distortion.

The interior of the tanks are painted a light gray to enhance visibility of internal components under oil. For 1000 kVA and below a bolted tank cover is standard. This permits thorough cleaning and complete painting prior to assembly, reducing the potential for contamination due to welding. Also, the tank cover is removable for field service without contaminating internal components and insulating oil. Tank covers are domed to facilitate moisture run-off. High-strength cover bolts are enclosed and concealed by a wrap-around cover guard, accessible only from inside the cabinet.

Cabinet

Patented high security features exceed ANSI requirements. The interlocked low-voltage compartment door has a three-point latching mechanism. Flush-fit doors with concealed latches and heavy-duty stainless steel hinges resist prying or probing. Doors are secured by a captive silicon bronze pentahead bolt.

A 20", 24", or 30" deep cabinet with removable sill is standard depending on kVA rating and accessory configuration. Full height 120° open doors have stops to hold them in the open position for ease of service.

Finish

An advanced multi-stage finish process exceeds ANSI standards. An eight-stage phosphate wash pretreatment assures coating adhesion and inhibits corrosion. Three-step electrodeposited and oven-hardened epoxy primer (E-coat) provides a barrier against moisture, salt, and other corrosives. Polyester powder coat (P-coat) provides resistance to abrasion and impact, and the urethane final coat adds ultraviolet protection.

THREE-PHASE VFI TRANSFORMER

The VFI transformer combines a conventional Cooper Power Systems distribution transformer with the proven Kyle Vacuum Fault Interrupter (VFI). This combination provides both voltage transformation and either transformer or loop overcurrent protection in one space saving, money saving package.

The three-phase VFI transformer with transformer protection protects the transformer and provides proper coordination with upstream protective devices. When a transformer fault or overload condition occurs, the VFI breaker trips and isolates the transformer, leaving the feeder uninterrupted.

The three-phase VFI transformer with loop protection protects the loop or downstream section of a feeder. When a fault occurs downstream, the VFI breaker trips and isolates the fault, leaving the transformer load uninterrupted.

The three-phase VFI breaker has independent single-phase initiation, but is three-phase mechanically gang-tripped. A trip signal on any phase will open all three phases. This feature eliminates single-phasing of three-phase loads. It also enables the VFI breaker to be used as a three-phase loadbreak switch. Because the VFI breaker is resettable, restoring three-phase service is faster and easier.

R-TRAN™ FM APPROVED TRANSFORMER

Cooper Power Systems' R-Tran Transformer is FM Approved for indoor locations. Factory Mutual Research Corporation's approval of the R-Tran transformer line makes it easy to comply and verify compliance with the 1996 National Electrical Code (NEC) section 450-23, Less-Flammable Liquid-Filled Transformer Requirements for both indoor and outdoor locations.

FM Approved R-Tran transformers offer the user the benefit of a transformer that can be easily specified to comply with NEC, and makes FM Safety Data Sheet compliance simpler, while also providing maximum safety and flexibility for both indoor and outdoor installations. Because the "FM Approved" logo is readily visible on the transformer and its nameplate, NEC compliance is now easily verifiable by the inspector.

Three-Phase Pad-mounted R-Tran FM Approved transformers from Cooper Power Systems are manufactured under strict compliance with FMRC Standard 3990, and are filled with FM Approved R-Temp fire-resistant dielectric coolant.

TESTING

Cooper performs routine testing on each transformer manufactured, utilizing our unique Automated Test Program. This integrated, computer controlled, series of tests provides all routine test data in real time, enabling virtually instant generation of certified test reports. The tests include:

- **Insulation Power Factor:** This test verifies that vacuum processing has thoroughly dried the insulation system to required limits.
- **Ratio, Polarity, and Phase Relation:** Assures correct winding ratios and tap voltages; checks insulation of HV and LV circuits.
- **Resistance:** Verifies the integrity of internal HV and LV connections; provides data for loss upgrade calculations.
- **Routine Impulse Tests:** The most severe test, simulating a lightning surge. Applies one reduced wave and one full wave to verify the BIL rating.
- **Applied Potential:** Applied to both high-voltage and low-voltage windings, this test stresses the entire insulation system to verify all live-to-ground clearances.
- **Induced Potential:** 3.46 times normal plus 1000 volts for reduced neutral designs.

- **Loss Test:** These design verification tests are conducted to assure that guaranteed loss values are met and that test values are within design tolerances. Tests include no-load loss and excitation current along with impedance voltage and load loss.

- **Leak Test:** Pressurizing the tank to 7 psig assures a complete seal, with no weld or gasket leaks, to eliminate the possibility of moisture infiltration or oil oxidation

Design performance tests include:

- **Temperature Rise:** Our automated heat run facility ensures that any design changes meet ANSI temperature rise criteria.
- **Audible Sound Level:** Ensures compliance with NEMA requirements.
- **Lightning Impulse:** To assure superior dielectric performance, this test consists of one reduced wave, two chopped waves and one full wave in sequence, precisely simulating the harshest conditions.

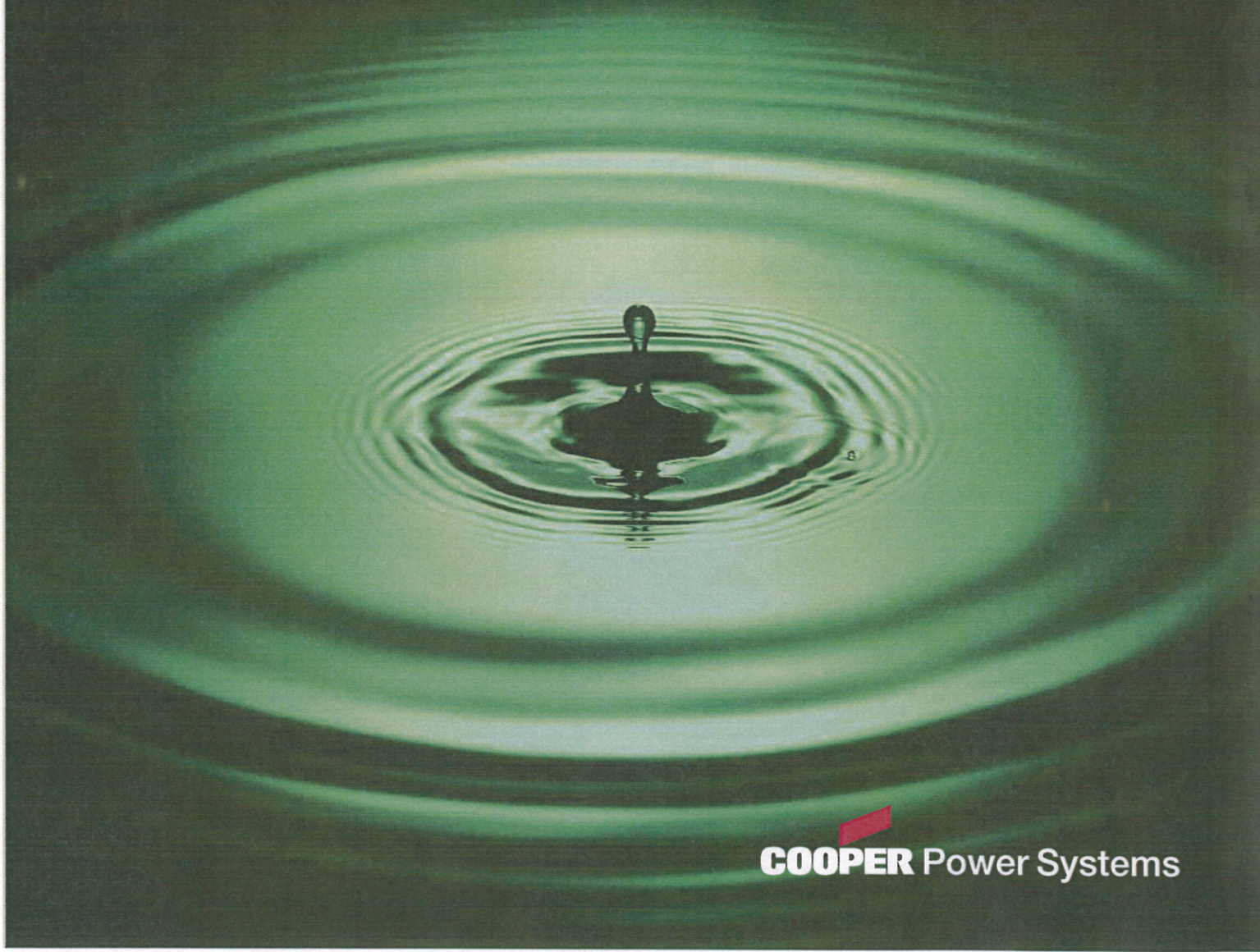
We are constantly striving to introduce new innovations to the transformer industry, bringing you the highest quality transformer for the lowest cost. Cooper Power Systems Transformer Products is working towards ISO9001 compliance, emphasizing process improvement in all phases of design, manufacture, and testing. We are so dedicated to introducing new innovations and technologies to the transformer industry we have invested millions of dollars in the Thomas A. Edison Technical Center, our premier research facility in Franksville, Wisconsin. Headquarters for the Systems Engineering Group of Cooper Power Systems, this research facility is fully available for use by our customers to utilize our advanced electrical and chemical testing labs.


COOPER Power Systems

The Question Isn't:

CAN YOU AFFORD

TO SWITCH?



COOPER  Power Systems



The Question Is:

CAN YOU AFFORD

NOT TO?

REVOLUTIONARY.

RELIABLE.

RESPONSIBLE.

Fires and mineral oil spills can be very expensive consequences of transformer failure. Substation fires can cost in excess of \$10 million, while the cost of remediating mineral-oil spills can exceed \$1 million. In addition to the monetary costs, fires and spills are a public relations nightmare that can seriously affect your image.

But now you can significantly improve the safety of your transformers while improving their performance and protecting the environment. It's as simple as specifying Envirotemp® FR3™ fluid for use in new transformers and in retrofilling applications for mineral oil transformers.

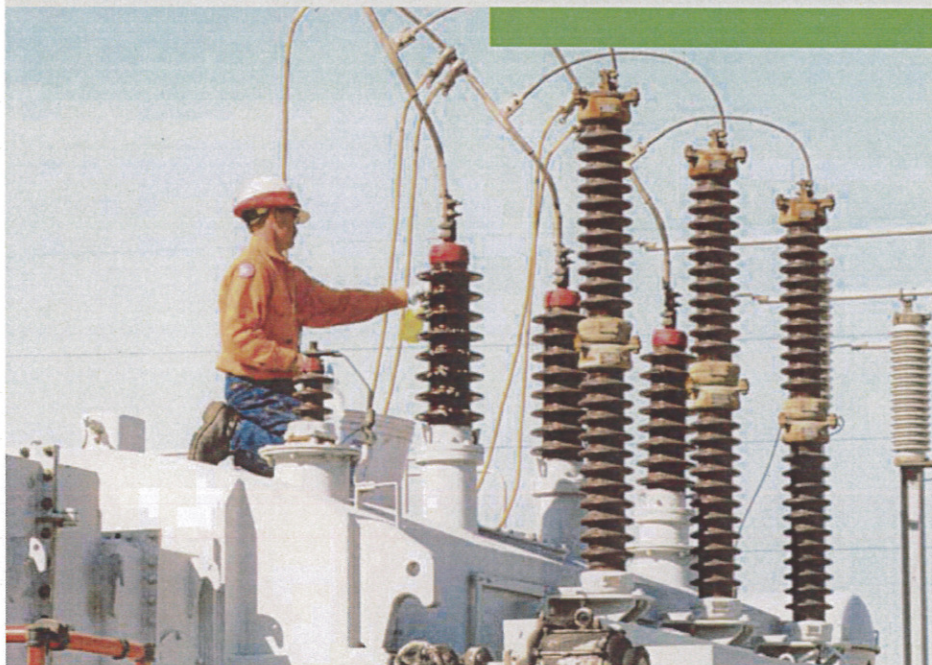
You can also take comfort in knowing that the environmental advantages of FR3™ fluid have made it the first dielectric coolant to receive the Environmental Technology Verification (ETV) from the U.S. and California EPAs. And with its excellent fire safety properties, this revolutionary dielectric fluid has gained the approval of demanding organizations such as Underwriters Laboratories Inc.® and FM® Global.

FR3™ fluid is a low, one-time investment that can pay for itself many times over by extending the life of your transformer, increasing the overload capability and reducing maintenance costs.

So... What are you waiting for?



Strive for a fire-free future.



On average, two power transformer fires take place in the U.S. every day.

With FR3™ fluid, you have it within your power to virtually eliminate transformer fires... and the huge costs associated with them.

Thousands of FR3™ fluid-filled transformers and other units have been installed in the field since the earliest prototypes began operating in 1996. To date, there's only one word to describe their safety record: flawless.

FR3™ fluid. Because even one transformer fire is one too many.

The natural resource.



Maintaining safe working conditions within your company is of paramount importance. But today, protecting the environment is equally essential to everyone's well-being.

Derived from edible vegetable oils, FR3™ fluid is from the earth. It's been tested nontoxic* – and it's recyclable. In addition, it exceeds the U.S. EPA's own standard for ultimate biodegradability.

You can take a huge step in minimizing the impact your business has on the environment by simply switching to FR3™ fluid; after all, it's only natural.

*Per OECD G.L. 203



The bottom line.



You're challenged every day to make fiscally responsible decisions for your company that will improve your bottom line. That's why specifying FR3™ fluid for new transformer and retrofit applications makes perfect financial sense.

You'll not only delay asset replacement; you'll actually improve the performance of your transformers by increasing their loadability. In fact, your investment in FR3™ fluid can become cash flow positive with just two years of transformer life extension.

And here's something else to consider: the one-time cost of retrofitting with FR3™ fluid can be considered a capital investment, not an expense.



It pays to switch **NOW!**

REVOLUTIONARY FR3™ fluid provides immediate safety and environmental advantages as well as performance benefits and *savings*.

FR3™ fluid makes your equipment more **RELIABLE:**

- Extends transformer paper life by 5 to 8 times
- Has fire and flash points more than twice that of mineral oil

Switching to FR3™ fluid is environmentally **RESPONSIBLE:**


- A biodegradable, nontoxic* and recyclable solution
- EPA designated as having "ultimate biodegradability"

Switching to FR3™ fluid is a **SOUND FINANCIAL DECISION:**

- Can cut fire safeguarding costs for substations by hundreds of thousands of dollars
- Reduces or eliminates remediation costs should spills occur
- Contributes to increased loading capability and longer transformer life
- FR3™ fluid retrofills can be cash flow positive within two years

*Per OECD G.L. 203

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Envirotemp® is a registered trademark of Cooper Industries, Inc.
The color "green" for dielectric fluid is a registered trademark of Cooper Industries, Inc.
FR3™ fluid is a trademark of McGraw-Edison Company
UL® is a registered trademark of Underwriters Laboratories Inc.
FM® is a registered trademark of Factory Mutual Insurance Company

**COOPER** Power Systems

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ENVIROTEMP® FR3™ FLUID

DESCRIPTION

Envirotemp® FR3™ fluid is a Fire Resistant Natural Ester based dielectric coolant specifically formulated for use in distribution transformers where its unique environmental, fire safety, chemical, and electrical properties are advantageous.

Envirotemp FR3 fluid is formulated from edible seed oils and food grade performance enhancing additives. It does not contain any petroleum, halogens, silicones or any other questionable material. It quickly and thoroughly biodegrades in both soil and aquatic environments. The fluid tested non-toxic in aquatic toxicity tests. It is tinted green to reflect its favorable environmental profile.

Envirotemp FR3 fluid has an exceptionally high fire point of 360°C and flash point of 330°C. It has the highest ignition resistance of less-flammable fluids currently available. It is referred to as a High Fire Point or "Less-Flammable" fluid, and is Listed as a Less-Flammable Dielectric Liquid by Factory Mutual and Underwriters Laboratories for use in complying with the National Electric Code® (NEC®) and insurance requirements.

Envirotemp FR3 fluid is compatible with standard transformer insulating materials, components and with fluid processing equipment and procedures. It demonstrates improved thermal characteristics with a viscosity closer to conventional transformer oil, superior dielectric strength in new and continued service applications, and excellent chemical stability over time.

Because of its excellent environmental, fire safety and performance characteristics applications for Envirotemp FR3 fluid have expanded into a variety of other equipment, including sectionalizing switches, transformer rectifiers, electromagnets, and voltage supply circuits for luminaries. Other potential applications under study include voltage regulators, high voltage cables, and power substations. The fluid is also used in retrofill applications for other fluid filled distribution equipment.

TYPICAL INITIAL ENVIROTEMP FR3 FLUID PROPERTIES

Property	Value	Test Method
<i>Electrical</i>		
Dielectric Strength	56 kV @ 25°C (0.080" gap) 47 kV @ 25°C	ASTM D1816 ASTM D877
Relative Permittivity [Dielectric Constant]	3.2 @ 25°C	ASTM D924
Dissipation Factor [Power Factor]	0.05% @ 25°C	ASTM D924
Volume Resistivity	30 X 10 ¹² Ω-cm @ 25°C	ASTM D1169
Impulse Strength (Sphere to Sphere)	226 kV @ 0.15" gap	ASTM D3300
Gassing Tendency	-79 (µL/min.)	ASTM D2300
<i>Physical and Chemical</i>		
Specific Gravity	0.92 @ 25°C	ASTM D1298
Interfacial Tension	27 mN/m @ 25°C	ASTM D971
PH	5.8	EPA 9045C
Neutralization (Acid) Number	0.022 mg KOH/g	ASTM D974
Kinematic Viscosity	33 cSt @ 40°C 8 cSt @ 100°C	ASTM D445
Moisture Content	20 mg/kg	ASTM 1533B
Percent Saturation of Moisture	1 - 2%	CPS Method
Air Solubility	16% @ 25°C @ 1 atm.	ATSM D2779
Appearance	Clear, Light Green	ASTM D1524
Color	L 0.5	ASTM D1500
<i>Thermal</i>		
Flash Point (Closed Cup)	316°C	ASTM D93
Flash Point (Open Cup)	330°C	ASTM D92
Fire Point (Open Cup)	360°C	ASTM D92
Pour Point	-21°C	ASTM D97
Thermal Conductivity	4.0 X 10 ⁻⁴ cal/(cm • sec • °C) @ 25°C	CPS Method
Specific Heat	0.45 (cal/gm/°C) @ 25°C	ASTM D2766
Coefficient of Expansion	7.4 x 10 ⁻⁴ /°C @ 25°C	CPS Method
Heat Capacity	2.10 @ 50°C 2.39 @ 100°C	ASTM E1269
<i>Environmental Properties</i>		
BOD/COD Ratio	45%	APHA SM5210B
Aquatic Biodegradation	100%	EPA OPPTS 835.3100
Acute Toxicity to Trout Fry	Zero Mortality to Test End Point	OECD G.L. 203

The typical properties shown above are for new fluid prior to factory shipment. These properties are subject to change without notice. Contact CPS Dielectric Fluids Products for recommended acceptance values. Ask for Envirotemp FR3 fluid Specification Guideline, Bulletin 97080.

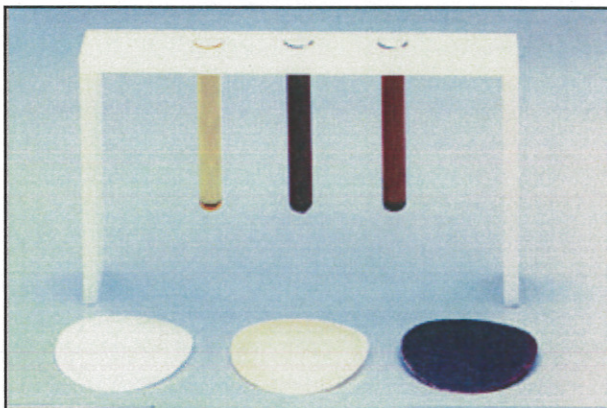
Bulletin 00092
Product Information
June, 2001

(Supersedes May, 2001)

PERFORMANCE

The unique chemical structure of Envirotemp FR3 fluid provides superior performance characteristics. The fluid maintains its dielectric strength much better than other dielectric fluids when used as a load-break switch medium, and has the lowest gassing tendencies under electrical stress. Its cooling performance is superior to other less-flammable fluids. It has lower viscosity at operating temperatures than other less-flammable fluids. The fluid exhibited no measurable change in viscosity over exhaustive testing cycles. It has superior resistance to coke and sludge formation when compared to conventional transformer oil. Under the same accelerated coking tests, Envirotemp FR3 fluid produced less than 1/20 of carbonaceous coke than that produced in mineral oil. Doble Laboratories sludge-free life test resulted in no measurable sludge.

Thermal Stability Test



Left to right: Envirotemp FR3 fluid, R-Temp fluid and Conventional Transformer Oil after 120 hours at 165°C.

Envirotemp FR3 fluid has an exceptional ability to draw out retained moisture and absorb water driven off by aging paper. It also chemically helps prevent the paper molecules from severing when exposed to heat. These attributes enable the fluid to significantly minimize the rate of aging of transformer insulating paper. Tests have shown that paper aged in Envirotemp FR3 fluid takes 5-8 times longer to reach the same end-of-life points as paper aged in conventional transformer oil.

The following chart shows a comparison of the time to reach insulation end-of-life for thermally upgraded Kraft paper aged in conventional trans-

former oil and Envirotemp FR3 fluid. Time to insulation end-of-life using IEEE C57.91 transformer loading guide calculation included for comparison.

Transformer Insulating Paper End-of-Life (Hours)

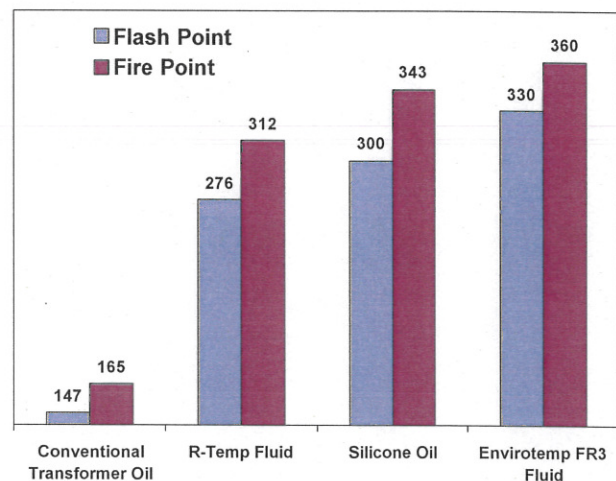
End-of-Life Basis	150°C			170°C		
	Mineral Oil	Envirotemp FR3 Fluid	IEEE Basis	Mineral Oil	Envirotemp FR3 Fluid	IEEE Basis
Retained Tensile Strength						
50%	3100	>4000*	1602	240	1300	323
25%	4000	>4000*	3327	490	4000	671
Degree of Polymerization 200	3200	>4000*	3697	480	3400	746

* Paper did not reach end-of-life over the duration of the test. To be conservative, extrapolation was not employed.

FIRE SAFETY

Envirotemp FR3 fluid has a fire point of 360°C, well above the NEC minimum of 300°C. Its flash point (330°C) is higher than the fire point of most other currently available less-flammable fluids. Envirotemp FR3 fluid is certified as a less-flammable dielectric coolant by Factory Mutual and Underwriters Laboratories in compliance with the listing requirements of the NEC. The National Fire Protection Association has no reports of fires or explosions involving transformers filled with Envirotemp FR3 fluid.

Flash & Fire Point of Dielectric Fluids (°C)

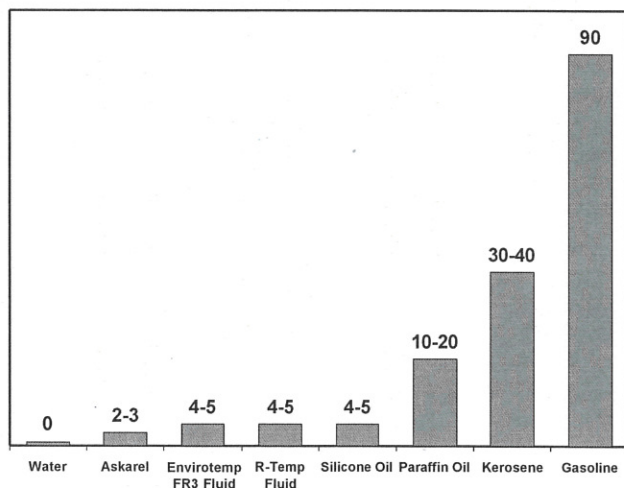


In large and small-scale tests, Envirotemp FR3 fluid has demonstrated greater fire resistance than other askarel substitutes. Based on large-scale testing, Factory Mutual Research concluded that the probability of a pool fire evolving the fluid was so low, that it does not require heat release rate to be deter-

mined nor applied in determining the installation requirements of the fluid. Factory Mutual accepts Envirotemp FR3 fluid for transformers Approved per FM Standard 3990. OSHA has recognized this FM standard as fitting the definition of a Listed and Labeled product per NEC Section 110-3(b). The standard permits Envirotemp FR3 fluid-filled transformers to be installed indoors, typically without sprinklers or vaults, with minimum clearance to walls of just 36 inches.

Underwriters Laboratories developed Standard 340 to compare the fire hazard rating of different fluids. The following graph demonstrates the favorable rating assigned to Envirotemp FR3 fluid.

Fire Hazard Rating UL Standard 340



MEETING THE CODES

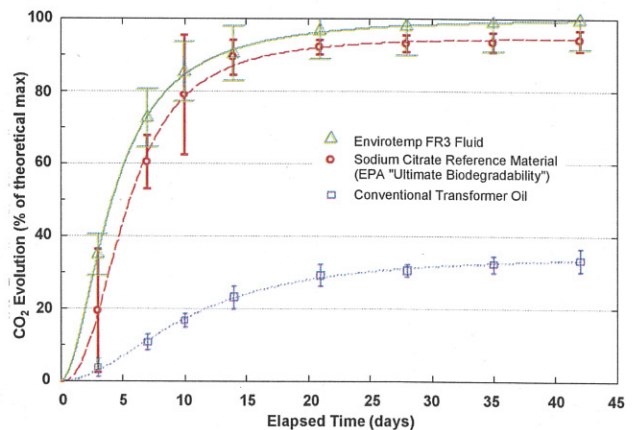
Less-Flammable fluids are recognized as a fire safeguard by Section 15 of the National Electrical Safety Code (Accredited Standards Committee C2). Envirotemp FR3 fluid meets the National Electrical Code Section 450-23 requirements as a listed less-flammable liquid. It is covered by OSHA Article §1910.305, Section 5(v).

Envirotemp FR3 fluid is Factory Mutual Approved and UL Classified "Less-Flammable" per NEC Article 450-23, fitting the definition of a Listed Product per NEC. For additional information, request the NEC Requirement Guidelines, Bulletin 92046.

ENVIRONMENTAL & HEALTH

Envirotemp FR3 fluid is specifically formulated to minimize health and environmental risk. It is made of food grade seed-oils and food grade performance enhancing additives. The base oils come from renewable resources - commodity seeds - and are easily recyclable and reusable. It does not require genetically altered seed-oils. It has a trademark green tint to help differentiate it from other dielectric fluids. Its biodegradation rate is as good as the Environmental Protection Agency® standard reference material, deemed "ultimately biodegradable" per EPA.

**Aerobic Aquatic Biodegradation Graph
EPA Test OPPTS 835.3100**



In one of the most extremely sensitive acute toxicity tests, the Trout Fry Acute Toxicity test OECD G.L. 203, Envirotemp FR3 fluid out-performed other dielectric fluids by achieving a zero mortality rate throughout the entire test period.

Because Envirotemp FR3 fluid is formulated from food-grade oils and additives, it is not subject to the Federal Regulation of Used Oils (Title 40, No. 270). It is instead covered by the Edible Oil Regulatory Reform Act (US Public Law 104-55, 1995), and therefore eligible for current and future regulatory relief. The option of alternative spill response procedures, such as natural bio-remediation, are now more viable. The fluid's slightly higher viscosity when compared to conventional transformer oil, combined with its ability to polymerize when thin layers are exposed to warmth and air flow, help prevent migration along the surface and into subsurface soils.

Envirotemp FR3 fluid is not listed as hazardous by Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) or the Department of Transportation (DOT). Oral toxicity animal tests reported no signs of toxicological reactions, nor have human contact reactions been reported. Envirotemp FR3 fluid is not classified as bioaccumulating or mutagenic. It is a candidate for classification as an "Environmentally Preferred Product". Its Hazardous Material Information System (HMIS) rating is 0 for both health and reactivity, and negative for carcinogenicity, National Toxicology Program (NTP), International Agency for Research on Cancer (IARC) monographs and OSHA Regulation. The thermal decomposition by-products from Envirotemp FR3 fluid are essentially limited to CO₂ and H₂O, with trace CO depending on the availability of oxygen and temperature. Envirotemp FR3 fluid can not produce PCDFs (Furans), PCDDs (Dioxins), nor silicates.

Additional product safety information is provided in the Envirotemp FR3 fluid Material Safety Data Sheet (MSDS), Bulletin 98082, available upon request.

APPLICATIONS

■ NEW TRANSFORMERS

Transformers filled with Envirotemp FR3 fluid for indoor, submersible and outdoor applications are available from several manufacturers worldwide.

For indoor applications, Envirotemp FR3 fluid-filled transformers not only provide the proven performance of liquid-filled design, but at a lower total life cycle cost than other alternatives with equal ratings.

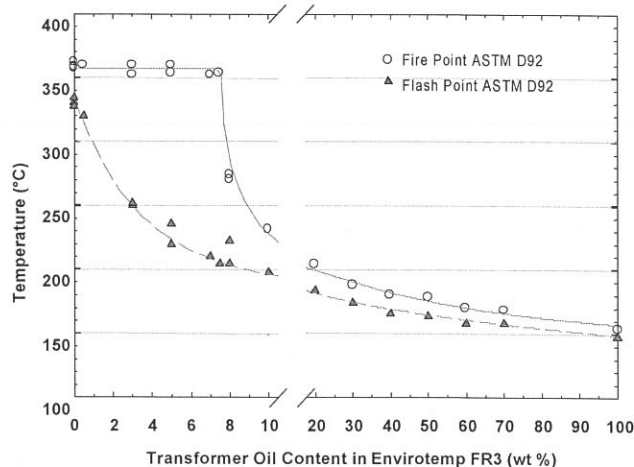
Envirotemp FR3 fluid-filled transformers are also an excellent choice for outdoor, network or subsurface vault installations where an extra margin of safety against explosion and fire is required. It is also preferred where protection from adverse environmental impact is desired as compared to other dielectric fluids such as conventional transformer oil. Outdoor applications where enhanced safety is recommended include close proximity to buildings or valuable equipment, rooftop installations and close proximity to pedestrian areas. Types of transformers presently operating with Envirotemp FR3 fluid include pole-mounted, pad-mounted, small and medium power substations.

Envirotemp FR3 fluid filled transformers are accepted in both industry and government. The fluid's favorable health and environmental properties make Envirotemp FR3 fluid-filled transformers a frequent choice in food and pharmaceutical processing plants. Contact CPS Dielectric Fluids Products or your equipment supplier for a copy of the Envirotemp FR3 Fluid User's List, Bulletin 99020.

■ RETROFILLING TRANSFORMERS FILLED WITH CONVENTIONAL TRANSFORMER OIL

Envirotemp FR3 fluid is well-suited as a replacement fluid for upgrading the safety margin of fluid-filled transformers from both an environmental and fire safety aspect. It is fully miscible with conventional transformer oil, High Molecular Weight Hydrocarbons (HMWH), and most askeral substitutes. Unlike retrofilling with other less-flammable fluids, the residual transformer oil that remains in the transformer typically will not reduce the fire point below the NEC minimum of 300°C. This is true even after full equilibrium has been achieved between the replacement fluid and the residual oil in the paper.

Envirotemp FR3 Fluid
Flash & Fire Point Variation with
Conventional Transformer Oil Content

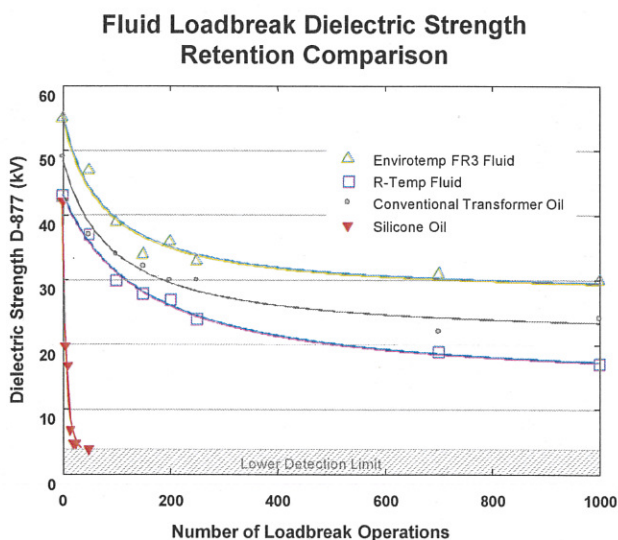


Additional advantages of retrofilling with Envirotemp FR3 fluid include high dielectric strength, excellent lubricity, material compatibility, and a coefficient of expansion similar to conventional transformer oil. The fluid also acts as a drying agent for transformer insulation that has become wet from aging, this property helps extend the useful life of the transformer insulation system.

Envirotemp FR3 fluid does not cause foaming in transformer oil like trace amounts of silicone oil can under vacuum degassification. Nor does it cause paint adhesion problems, nor form the carbon silicates during switching that can lead to a severe reduction in dielectric strength.

■ LOADBREAK SWITCHING DEVICES

Excellent dielectric strength retention, lubricity, essentially non-coking, and a very low gassing tendency make Envirotemp FR3 fluid an excellent loadbreak switching medium at temperatures above -10°C. Proven applications include new and retrofilled sectionalizing switches, and transformers with loadbreak accessories such as bay-o-net fusing, on-off switches, sectionalizing switches and Vacuum Fault Interruption protection devices.



Due to viscosity differences compared to conventional transformer oil, suitability of each application should be reviewed by the equipment manufacturer particularly for very low ambient temperature installations.

■ OTHER APPLICATIONS

The inherent safety and performance properties of Envirotemp FR3 fluid have led to its application in electrical equipment other than transformers, including industrial electromagnets, klystron modulators, transformer/rectifier sets, power supplies for luminars, and heat transfer applications for testing equipment. Envirotemp FR3 fluid has excellent lubricity, an impor-

tant characteristic for application in equipment with movable parts. High voltage oil impregnated paper, cable, and bushing application also appear very promising due to the fluid's excellent ability to minimize insulating paper degradation and its desirable gassing tendency value of -79 $\mu\text{L}/\text{min}$.

The suitability of each application of Envirotemp FR3 fluid is the responsibility of the user. Contact CPS Dielectric Fluids Products for application guidelines.

Note: Occasional headspace exposure to air can occur, such as the operation of pressure relief devices, temporary hand-hole cover removal, etc. without detectable degradation of the fluid properties. However, minimal air exposure is preferred as the fluid is more susceptible to oxidation than petroleum based products. Applications with continuous free breathing equipment is not recommended.

FIELD PERFORMANCE HISTORY

Since the energization of prototypes in 1996, hundreds of Envirotemp FR3 fluid-filled distribution transformers and equipment have been installed, accumulating centuries of unit-years of reliable field service. Their performance and fire safety record has been flawless. In addition to new transformer application, conventional transformer oil-filled units have also been successfully retrofilled and operated with Envirotemp FR3 fluid. All units have maintained a long term fire point well in excess of 300°C. The monitoring of operating Envirotemp FR3 fluid-filled transformers, including the earliest prototypes, has demonstrated Envirotemp FR3 fluid to be exceptionally stable. Dissolved gas analysis has proven to be functional for transformer preventative maintenance.

GENERAL INFORMATION

■ STORAGE AND HANDLING

The same basic procedures for storing and handling conventional transformer oil should be followed with Envirotemp FR3 fluid. To help maintain the extremely low percent moisture saturation at time of fluid manufacture, it is recommended that exposure time to air be as minimal as practical. Drum and tote

storage should be indoors or outdoors protected from the elements. For additional storage and handling information contact CPS Dielectric Fluids Products or your equipment supplier and request Bulletin 99048.



Prior to shipment, Envirotemp FR3 fluid undergoes extensive quality assurance testing. The facility where Envirotemp FR3 fluid is produced is ISO 9001 Certified.

■ FLUID MAINTENANCE

Periodic maintenance tests for Envirotemp FR3 fluid-filled equipment should follow the same schedule used for transformers filled with conventional transformer oil. Recommended maintenance tests include:

1. Dielectric strength per ASTM D1816. The acceptable limit for continued use of service-aged Envirotemp FR3 fluid is 30 kV minimum (69 kV equipment and below).
2. Flash Point and Fire Point. Relatively small amounts of conventional oil should not significantly reduce the flash point and fire point of Envirotemp FR3 fluid. Contamination above 7.5% may reduce the fire point to under 300°C. If it is suspected that the fluid may be contaminated, flash point and fire point should be measured in accordance with ASTM D92.
3. Dissolved Gas Analysis. Recommended particularly for high value equipment or equipment servicing critical loads. ANSI/IEEE guide C57.104-1991 for detection and analysis of generated gases should be applied.

4. Testing one or more of the following properties provides a good indication of possible fluid contamination or unusual degradation. Acceptable limits for continued use of service-aged Envirotemp FR3 fluids:

Dissipation Factor	D924	1.0% at 25°C max.
Neutralization Number	D974	2.5 mg KOH/g max.
Interfacial Tension	D971	18 mN/m

For fluid that cannot be reconditioned, recommended disposal options include selling to processors for recycling/refining, or conversion into bio-diesel oil, or blending with fuel oil for industrial grade boilers and industrial furnaces. Assuming the fluid has not been contaminated by controlled materials, the used fluid is not under the jurisdiction of the Federal Used Oil Regulation (Title 40, No. 279).

PROPERTIES FOR ENVIROTEMP FR3 FLUID-FILLED EQUIPMENT

Property	Typical Values In New Equipment	Value Limits for Continued Service	ASTM Test Method
<i>Electrical</i>			
Dielectric Breakdown (kV)	45	-	D877
	55	≥34	D1816
Dissipation Factor (%)	0.13	≤1.0	D924
Volume Resistivity (10 ¹² Ω-cm)	30	-	D1169
<i>Physical</i>			
Flash Point (°C)	330	-	D92
Fire Point (°C)	360	≥300	D92
Pour Point (°C)	-21	-	D97
Viscosity (cSt)	33 (40°C)	-	D445
	8 (100°C)	-	
Appearance	clear, lt. green	-	D1524
Color	L 0.5	-	D1500
<i>Chemical</i>			
Moisture Content (mg/kg)	50	≤400	D1533B
Neutralization Number (mg KOH/g)	0.04	≤2.5	D974
Interfacial Tension (mN/m)	24	≥18	D971

■ SPECIFICATION GUIDELINE

The dielectric coolant shall be a listed less-flammable fluid meeting the requirements of National Electrical Code Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-1997), Section 15. The fluid shall be non-toxic, non-bioaccumulating and be readily and completely biodegradable per EPA OPPTS 835.3100. It shall be comprised of edible oils and food grade performance enhancing additives. It shall result in zero mortality when tested on trout fry per OECD G.L. 203. It shall not require oils derived from genetically altered seeds. It shall be Factory Mutual Approved and UL Classified, Envirotemp FR3 fluid or equal. It shall have a minimum open cup flash point of $\geq 325^{\circ}\text{C}$ and a fire point of $\geq 350^{\circ}\text{C}$ per ASTM D92.

ORDERING INFORMATION

To order Envirotemp FR3 fluid, specify:

	<u>Catalog Number</u>
Bulk	0425200A03
330 gallon Ecobulk container	0425589A05
55 gallon drum	0425589A08
5 gallon container	0425589A09

For warranty, sales terms and conditions information contact CPS Dielectric Fluids Products or your equipment supplier for Cooper Power Systems Terms and Conditions Sheet.

To the best of our knowledge, the information and data in this brochure are accurate at the time of printing.

UL CLASSIFICATION MARKING



CLASSIFIED BY UNDERWRITERS LABORATORIES INC.® AS TO FIRE HAZARDS ONLY.

Envirotemp® FR3™ Fluid. Classed 4 to 5 less hazardous than paraffin oil in respect to Fire Hazard.

CLASSIFIED BY UNDERWRITERS LABORATORIES INC.® AS TO SECTION 450-23 OF THE 1999 NATIONAL ELECTRICAL CODE.

Classified as a "Less-flammable liquid" as specified in the National Electric Code when used in 3-phase transformers, 45 through 10,000 kVA with the following "use restrictions":

- A For use only in 3-phase transformers having tanks capable of withstanding an internal pressure of 12 psig without rupture,
- B Required use of pressure relief devices on transformer tank in accordance with the following tabulation to limit internal pressure buildup and prevent tank rupture due to gas generation under low current arcing faults, and
- C1 Required use of current limiting fusing in the transformer primary having I^2t characteristics not exceeding the values in the following tabulation. Under-fluid expulsion fuses may be used in series with the current-limiting fuses, in accordance with the manufacturer's protection scheme,
- or
- C2 Required use of overcurrent protection in the transformer primary having I^2t characteristics not exceeding the values in the following tabulation. If the fuse is designed to vent during operation (such as an expulsion fuse), it shall be located external to the transformer tank.

TRANSFORMER	REQUIRED PROTECTION		REQUIRED PRC
3-Phase Transformer Rating, kVA	Required Current Limiting Fusing (+) Maximum I^2t (A ² s)	Required Overcurrent Protection (+) Maximum I^2t (A ² s)	Minimum Required Pressure Relief Capacity, (++) SCFM at 15 psi
45	500,000	700,000	35
75	500,000	800,000	35
112.5	550,000	900,000	35
150	600,000	1,000,000	50
225	650,000	1,200,000	100
300	750,000	1,400,000	100
500	900,000	1,900,000	350
750	1,100,000	2,200,000	350
1,000	1,250,000	3,400,000	350
1,500	1,500,000	4,500,000	700
2,000	1,750,000	6,000,000	700
2,500	2,000,000	7,500,000	5,000
3,000	2,250,000	9,000,000	5,000
3,750	2,500,000	11,000,000	5,000
5,000	3,000,000	14,000,000	5,000
7,500	3,000,000	14,000,000	5,000
10,000	3,000,000	14,000,000	5,000

(+)- This is an additional requirement to the overcurrent protection required in accordance with Section 450-3 of the 1999 National Electrical Code.

(++)- Opening pressure, 10 psig maximum.

COOPER Power Systems

Dielectric Fluids Products
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www.cooperpower.com

Appendix C

Module User's Guide



FS Series 2 PV Module User Guide – North America

1.0 Introduction

First Solar Series 2 PV modules are manufactured in state-of-the-art facilities using a breakthrough process that rapidly deposits thin films of compound semiconductor material on glass. The modules have been designed to have a long operating life and high energy yield—if installed, operated, and serviced in accordance with the instructions in this User Guide.

1.1 Key Product Features

- High energy production in real-world conditions.
- Size and weight that enables efficient handling and installation.
- Easy, quick-connect wiring for fast interconnection.
- Internationally recognized product certifications.
- Five-year limited material/workmanship and twenty-five year limited power output warranties as outlined in “First Solar FS Series Module Warranty Terms & Conditions” (PD-5-102).

1.2 Before You Begin

This document provides guidelines and information on First Solar FS Series 2 PV modules for system designers, installers, and maintenance personnel. We encourage you to read this User Guide thoroughly before beginning any work related to the installation, operation, or maintenance of the First Solar Series 2 PV module. Only qualified personnel should install, operate, or maintain a PV module or system.

This guide pertains to modules installed within North America only. If a module is being installed outside of North America, contact First Solar or the product distributor for the User Guide appropriate

for other geographic areas.

Guidelines related to workmanship are beyond the scope of this document and are not covered in this document.

2.0 Warnings & Cautions



The FS Series 2 PV Modules may produce voltage in excess of 90 Volts DC (V_{DC}) and current in excess of 1.0 Amp when exposed to sunlight.

A single module could represent a lethal shock hazard during hours of daylight, including periods of low light levels. The danger increases as modules are connected together in series and/or parallel.

Do not disconnect the module connectors during daylight hours unless the module is in an open circuit condition or all modules in series and parallel are covered with an opaque material, such as a tarp or blanket. An electrical arc could occur and pass through the fingers and body of the person holding the two ends of the connector.

Never allow the PV array open-circuit voltage to exceed $1000V_{DC}$ under any condition (e.g. cold winter conditions). Leakage currents could create a shock hazard or fire. To remain compliant in UL Listed and Recognized applications, the system design must ensure the PV array open-circuit voltage does not exceed $600V_{DC}$.

Keep all array wiring out of reach of non-qualified personnel. Defective or damaged wiring could result in an electrical shock hazard.

Do not concentrate light on the module in an attempt to increase power output.

2.1 Recommended Safe Practices

- Wear eye protection when working on modules or systems.
- Do not work on modules or systems when the modules or wiring are wet.
- Replace broken modules as they represent a shock hazard due to leakage currents, especially when wet.
- Comply with all local codes and permit requirements.

First Solar FS Series 2 PV modules have been listed to UL 1703, the standard for Flat-Plate Photovoltaic Modules and Panels. To remain compliant in UL Listed applications, use only components that have been Recognized or Listed by Underwriters Laboratories (UL) for their intended purpose.

For systems installed in the United States, all installation must comply with the National Electrical Code (NEC). Refer to Article 690 of the NEC which applies to 'Photovoltaic Systems'.

For systems installed in Canada, installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.

Before beginning the PV system design and installation, contact appropriate local authorities to determine local code, permit, and inspection requirements.

3.0 Electrical Specifications

Model Numbers and Ratings at STC*					
Nominal Values		FS-270	FS-272	FS-275	FS-277
Nominal Power (+/-5%)	P _{MPP} (W)	70	72.5	75	77.5
Voltage at P _{MAX}	V _{MPP} (V)	65.5	66.6	68.2	69.9
Current at P _{MAX}	I _{MPP} (A)	1.07	1.09	1.10	1.11
Open Circuit Voltage	V _{OC} (V)	88.0	88.7	89.6	90.5
Short Circuit Current	I _{SC} (A)	1.23	1.23	1.23	1.22
Maximum System Voltage	V _{SYS} (V)	600			
Max. Source Circuit Fuse	I _{CF} (A)	2			

*Ratings at Standard Test Condition (1000W/m², AM1.5, 25°C Cell Temperature) +/-10% (Nominal Power +/- 5%)

Electrical specifications are subject to change. See the FS Series 2 datasheet and module label for additional electrical ratings.

3.1 System Derating Factors

Under normal conditions, a photovoltaic module may experience conditions that produce more current and/or more voltage than reported at Standard Test Conditions. Accordingly, when determining component ratings, the values listed for open circuit voltage should be multiplied by a calculated factor based on low temperature open circuit voltage temperature coefficient. Refer to First Solar Application Note PD-5-435 for additional information on the calculation of this voltage multiplication factor. Values listed for current should be multiplied by 1.25. Refer to Section 690-8

of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable in computation of maximum circuit current for proper conductor sizing.

4.0 Installation: Mounting

Caution: Modules should be handled with care during installation, as heavy impact on the front, back, or edges could result in damage to the module. Do not attempt to install the modules in high wind or wet conditions. Do not stack or carry multiple modules on top of one another after removal from factory packaging. Do not lift or pull on modules using lead wires or strain relief wire loops.

Mounting of the FS Series 2 PV module to a suitable structure can be done by attaching the module directly to the structure using retaining clips (see Figure 5.1).

Modules used in UL Listed applications must be installed with approved mounting systems as specified in First Solar Application Note PD-5-320 NA.

Additional mounting systems may be approved for use. Candidate retaining clip designs must meet the technical requirements specified in First Solar Application Note PD-5-320 NA, and must be approved for use by First Solar prior to installation. The mounting system design must provide adequate support for the glass laminate module to prevent damage from occurring when the module is subjected to wind loads of 130km/h, with a safety factor of 3 for gusty conditions. The location of the clips shall be along the 1200mm length of the module and the center point of the clip shall be located between 250mm and 300mm from the module edge. See Figure 5.1 for allowed location. Retaining clips must each provide a minimum contact area of 15mm x 80mm. Rubber gasket material, or equivalent must

be used between the module and both the clip and mounting structure to provide adequate protection of the glass laminate module. No direct contact of rigid structures is permitted against the surface or edges of the glass laminate.

All mounting structures must provide a flat plane for the modules to be mounted, and must not cause any twist or stress to be placed on the module.

Modules should not be installed in a way that restricts air circulation to the backside of the module. Modules generate heat and require adequate airflow for cooling.

Installation locations and module support structures should be selected to ensure modules are never submersed under standing water or covered by snow drifts.

Heavy construction and trenching should be completed prior to module installation to minimize debris and dust.

Ensure any soil binding agents or salts used for on-site dust control do not spray, splash, or drift onto the surface of the modules.

The UL approved design load of FS Series 2 PV modules is 30 lb/ft². Maximum allowable force on modules may not exceed 2400 Pa without additional module support that must be tested and approved by First Solar.

For rooftop mounting, modules must be mounted over a fire resistant roof covering rated for the application. The recommended minimum standoff height is 3.25 in. Modules used in UL Listed rooftop applications must be installed with approved mounting systems as specified in First Solar Application Note PD-5-320 NA. If alternate mounting means are employed, this may affect the Listing fire class ratings.

4.1 Location, Angle, and Tilt

To maximize performance, modules should be located in an area that receives direct sunlight from mid morning to mid afternoon (typically 9:00 a.m. to 3:00 p.m.). Avoid locating the modules where shadows may be caused by buildings, trees, etc.

PV performance modeling software should be used to determine the optimum orientation and tilt angle for each location.

4.2 Electrical Interconnection

First Solar FS Series 2 PV modules are pre-configured with industry standard connectors that are "touch proof" with all live parts protected against accidental contact, self locking, and protect against polarity reversal. The connectors are UV and weather resistant from -40°C to $+90^{\circ}\text{C}$, and rated for 1000V_{DC} (600V_{DC} UL) and 20A (before derating for ambient temperature).

Caution: PV module plug connections must not be unplugged while under load.

Lead wires must not be pulled tight at any time. After installation, the connected wire must not be under stress or tension.

Junction box assembly and lead wire strain relief loops must not be used to secure excess wire or to bear weight.

Components used to interconnect the modules must be compatible with the connectors, and provide proper system operation and fault protection as required by any applicable codes. Field wiring must be a minimum of #12AWG, rated for 90°C , and be of a type approved for use in accordance to the NEC.

FS Series 2 PV modules are designed for interconnection solely with grid-connected PV inverters capable of continuous operation at the maximum power point of the PV array. All inverters must meet the

technical requirements specified in First Solar Application Note PD-5-310 and must be approved by First Solar prior to installation. When connecting modules or module strings in series and/or parallel, ensure inverter ratings are appropriate.

First Solar recommends that modules not be operated in open or short circuit conditions for more than ninety (90) consecutive days to avoid a potential reduction in energy output over the life of the modules.

4.2.1 Grounding Method

First Solar FS Series 2 PV modules have no exposed conductive surfaces and do not require equipment grounding. The mounting structure must be grounded per the requirements of the NEC, sections 250 and 690.

4.2.2 Overcurrent Protection

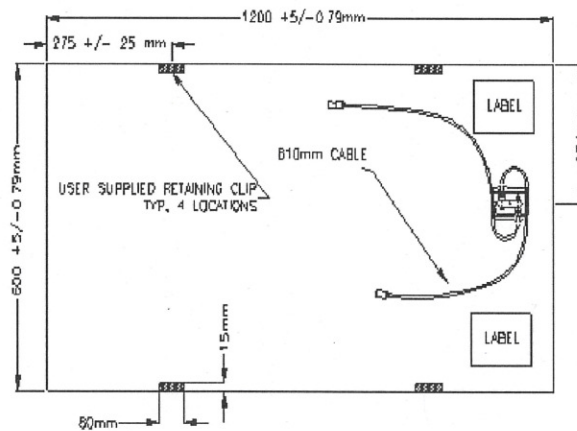
UL 1703, IEC 61730, and the NEC require a DC fuse with a 2A rating be included in a PV source circuit using FS Series 2 PV Modules. PV systems should be designed to comply with local codes and provide over-current protection levels appropriate for the intended application class of the system.

5.0 Mechanical Specifications & Drawings

Table 5.1: Mechanical Specifications

Specifications	FS Series 2 PV Module	
Length	1200 mm	47.25 in
Width	600 mm	23.63 in
Thickness	6.8 mm	0.27 in
Area (total aperture)	0.72 m^2	7.75 ft^2
Weight	12 kg	26.5 lbs
Fire Rating	Class C	Class C

Figure 5.1: Mechanical Drawing for FS Series 2 PV Modules



interconnected to modules must be rated for the maximum operating voltage of the array.

- Modules must have adequate ventilation and airflow to prevent excessive operating temperatures.
- Modules should not be shaded by obstructions at times of high irradiance (typically between 9:00am and 3:00pm).
- Modules should not be used in positive-grounded or bi-polar systems.
- Removal of strain relief cable ties will void module warranty.

6.0 Proper Operating Conditions

The proper operating condition requirements listed below must be maintained. Failure to maintain proper operating condition requirements for the modules will void the warranty (refer to First Solar FS Series Module Warranty Terms & Conditions PD-5-102).

Requirements:

- First Solar must be notified in writing if modules are operated in open or short circuit conditions for more than 90 consecutive days during the installation period or any subsequent operating period; for modules operated in open or short circuit conditions for 90 consecutive days or longer, First Solar requires installers to use commercially reasonable efforts to grid-connect the modules as soon as practicable.
- All electronic components that are interconnected to modules must have an operating voltage window that matches the maximum power point of the array, and be capable of operating the array at the maximum power point at all times.
- All electronic components that are

7.0 Service

- Periodically inspect modules for any signs of damage or broken glass.
- Broken modules should be replaced immediately.
- Check that all electrical connections are tight and corrosion free.
- Large amounts of dust and dirt on the surface of the module can reduce the power produced. The recommended cleaning method is to spray off the modules with water from a low pressure source (do not use high pressure water systems).
- Abrasive cleaners should never be used to clean the module.
- Please refer to "FS Series 2 PV Module Cleaning Guidelines" (PD-5-804) for additional information.

The most common causes of lower than expected PV system power output are:

- Inverter failure.

-
- Improper or faulty field wiring or connections.
 - Blown fuses or tripped circuit breakers.
 - Excessive amounts of dirt and dust on the modules.
 - Shading of modules by trees, poles, or buildings.

8.0 Warranty Terms & Conditions

Please refer to, "First Solar FS Series Module Warranty Terms & Conditions" (PD-5-102) for warranty terms, limitations, and product return policies.

Notice

Changes to certain components of the module are common as First Solar continuously strives for product improvements. Changes may be a result of component improvements or changes by a supplier, or by minor design modifications initiated by First Solar. All products within the same model classification remain functionally equivalent and fully compatible with one another, even though there may be slight differences. Modifications that do not impact the functionality of the product will typically be made without customer notification. Internal testing, and review or retesting by a certifying agency, will be completed before component or design changes are introduced into the manufacturing process.

First Solar products are sold by description only. First Solar reserves the right to make changes in solar module design and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that data sheets are current before placing orders. Information furnished by First Solar is believed to be accurate and reliable. However, no responsibility is

assumed by First Solar or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of First Solar or its subsidiaries.

This product is covered by one or more of the following United States Patents: 5,248,349; 5,470,397; 5,536,333; 5,945,163; 6,037,241; 6,559,411; 6,617,507; 6,719,848 and by Corresponding Foreign Patents and Patents Pending.

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Appendix D

Site EH&S Manual



Site EHS Manual

Commissioning, Operations & Maintenance Overview



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Revision History

Rev Number	Revision Description	Revision Date
0	Initial Issue	10-14-2009
1	Added new Section on Spill Prevention, Control and Countermeasures	02-01-2010
2	Added medical emergency response information to section 6.	04-19-2010



PART 1 - GENERAL SAFETY REQUIREMENTS

This Site EHS Manual provides an overview of First Solar's safety program; its policies, procedures and programs for Commissioning, Operations and Maintenance. Read this manual and retain it for reference. It was prepared to enhance Associate awareness of safety policies, procedures and programs, and to provide focus on the importance of workplace safety. It does not address every situation that will arise and, therefore, is not intended to serve as an exhaustive set of rules.

This Site EHS Manual and its related policies, practices and procedures as well as future updates are not intended as a contractual commitment or obligation of First Solar to its Associates. As in all matters, the Company will use its discretion to take action that it believes is appropriate in the particular circumstances based on legal provisions, interpretations of law and Associate relations principles.

From time to time, the company may change or discontinue certain policies and practices. At the start of work at a new jobsite obtain the latest revision number of the Site EHS Manual from your First Solar Site Manager/Designee. You are responsible for having the most current revision. It is our expectation that Associates will give their best effort, however failure to abide by First Solar, Client or government implemented policies, rules, regulations or guidelines may be subject to disciplinary actions up to and including termination.

We expect that you are committed to upholding the policies and procedures of First Solar. All of us at First Solar view safety as our primary concern. Not only is safety a concern in the workplace but also in our daily lives away from work. This Site EHS Manual has been designed to provide you the fundamentals to help maintain good safety awareness at work and play. Please use the safety guidance in this manual and share the ideas and safety tips with your families, friends and co-workers.

First Solar has coupled general personnel policies and guidelines with our Site EHS Manual. This information provides answers to questions commonly asked about First Solar policies. It obviously cannot answer every question and is not intended to do so. Contract Specific Requirements, site policies and procedures, and, if applicable, local labor agreements, should also be referenced anytime questions arise.

Our goal is to make our people aware of our policies and to make safety not just a set of rules, but a way of life. We are proud of the way in which we run our company with our focus on safety first, and expect you to share that sense of pride.

Site EHS Manual Acknowledgement Form

This Site EHS Manual has been prepared for your information and understanding of the policies, philosophies, practices and benefits of our company. PLEASE READ IT CAREFULLY. Upon completion of your review of this manual, please sign the Site EHS Manual Acknowledgement Form on Page 49 of this manual and return it to your First Solar Site Manager/Designee. For your records a reproduction of that statement appears below.



1 FIRST SOLAR CORE VALUES

First Solar places the highest priority on providing a safe product for our customers, and a safe work environment for our associates. Safety first means exactly that; we are committed to minimizing and eliminating safety risks to our customers and associates above all other obligations. If there's ever a choice to be made between our financial self interests and the safety of our associates and customers, we'll always address the safety issues first.

- + We value personal safety over financial results
- + We strive for an accident and injury free workplace
- + We are pro-active in providing a safe product and work environment
- + We are committed to minimize and eliminate risk to our associates

Environmental Responsibility

First Solar is committed to improving the environment, including compliance and pollution prevention throughout every phase of our product lifecycle. It's especially important that First Solar place a primary emphasis on environmental responsibility since our product essentially exists to improve and protect the environment. From raw material sourcing to the industry's only module recycling program, environmental responsibility is a key consideration in everything that we do.

People Matter

First Solar's success is primarily dependent upon our Associates. We rely heavily on the productivity, passion & commitment of our Associates to sustain our success. We're building a high throughout organization with a lean organization across the globe. Our strategy is to employ the best people possible and provide a global culture that fosters mutual respect, trust and growth for our Associates.

First Solar values associates who:

- + Are trustworthy (reliable, dependable, faithful, warranting trust)
- + Have integrity
- + Show respect for and work well with others
- + Are passionate
- + Communicate effectively

First Solar provides associates with:

- + Training & education
- + Opportunity for advancement
- + Team environment
- + Strong communication



Deep Customer Partnerships

Developing and maintaining customer partnerships pertains to both our internal & external customers. We want to understand our customer's needs and objectives, from our customer's perspective. We're proactively engaging with our customers to understand what they want to accomplish, what issues they're facing, and how they're addressing them.

At First Solar, we strive to:

- + Understand our customers and serve them better than anyone else in the world
- + Learn and understand our customer's requirements and needs
- + Learn and understand our customer's business from their point of view
- + Exceed expectations in items that matter to the business
- + Deliver on our promises

Results Matter

Results matter at every level of the organization. Are we creating the enduring value our customers require? As Associates, are we achieving results and meeting objectives that are clearly tied to our corporate mission? And most importantly, on a global scale are we truly creating a world that is powered by clean, affordable solar electricity?

At First Solar, we are disciplined, focused, and results oriented to meet our goals, and we recognize and celebrate our successes.

- + Disciplined: we establish methods and always follow approved systems and processes
- + Achievement of Goals: we hold ourselves accountable and responsible for the execution and delivering the results
- + Results-Oriented Mindset: we will always achieve our goals without compromising our core values
- + Flexibility and Adaptability: we are effective at accepting and managing change
- + Dedication: we are dedicated to the core values of the company
- + Tenacious and Passionate: we take a determined and enthusiastic approach to reach our goals

2 FIRST SOLAR GENERAL SAFETY RULES

First Solar is committed to complying with OSHA's safety standards and rules at all times. Safety is a joint responsibility and cooperative undertaking that requires ever-present safety awareness on the part of every associates. The following General Safety Rules apply to all job locations where First Solar Associates work.

No one shall be assigned or permitted to work while their ability or alertness is impaired by fatigue, illness, intoxicating liquor, illegal drugs, prescription drugs, etc. such that impairment of motor skills or other faculties might expose the individual or his or her co-associates to injury. Each individual is responsible to use safe work practices and follow the rules contained in our Client's Safety Program, the First Solar Site EHS Manual, and such other rules and practices communicated on the job via training or direction. These general safety rules are to protect you and your co-worker from harm and apply to all First Solar Associates:



- + Report immediately all injuries, near misses, unsafe conditions or work practices to your supervisor.
- + Maintain good housekeeping at all times in the work area.
- + Wear suitable clothing and footwear at all times.
- + Properly wear Personal Protective Equipment (PPE) whenever needed and where posted.
- + Participate in the safety awareness training sessions conducted by the First Solar Site Manager/Designee.
- + No horseplay.
- + No running on plant property.
- + Plan work carefully to avoid injuries.
- + Visually inspect machinery and equipment to ensure that all guards and other protective devices are properly placed and adjusted.
- + Report deficiencies promptly to your supervisor.
- + Do not use defective tools and equipment.
- + Do not throw or toss objects. Dispose of all waste properly and carefully.
- + Use proper body mechanics when lifting heavy objects. Ask for assistance or use mechanical devices to move heavy objects.
- + Stop work whenever you feel the job is unsafe and immediately contact your supervisor.

The First Solar Site Manager/Designee, supervisors, and lead workers are responsible for enforcing these rules; YOU are responsible for adherence to safety rules.

3 PURPOSE

This section of the Site EHS Manual highlights safety guidelines and rules and is intended to supplement the provisions of the Occupational Safety and Health Act of 1970 and any regulations issued there under, the First Solar Site EHS Manual, and similar manuals our Client may have. ***It does not take the place of required OSHA training and does not meet the intent of that training.*** The intent of this manual is to enhance Associate awareness regarding First Solar and Client safety policies and to provide focus on safety. It obviously cannot cover every situation and it is not intended to do so. Each job, regardless of the type of work involved, presents hazards that require special alertness, awareness, and good judgment on everyone's part. In addition, the requirements established by the particular site where the work is being performed must be complied with. **STOP** and familiarize yourself with the First Solar and/or Client EHS Manual if there are any questions, doubt, or if it is the first time working in the environment. The First Solar Site Manager/Designee, your supervisor and the home office will help. **YOU** are obligated to ask for help and guidance when there is any doubt.

The safety and health of each Associate of First Solar is of primary importance. One of our goals is to develop a Safety Program conforming to OSHA requirements. To be successful, such a program must embody the proper attitude towards accident prevention on the part of supervisors, Associates. It also requires cooperation in all safety and health matters between supervisors, Associates, as well as between each worker and his/her fellow workers.



All accidents in the workplace are preventable. In an effort to protect our most important resource ...**YOU**... our ultimate goal is to reduce the number of injuries to zero. Please do your part to assist us in making our workplace an even safer and better environment.

3.1 First Solar Site EHS Manual

The Site EHS Manual is available to First Solar Associates and Contractors and contains detailed information that will help maintain a safe work environment. The Site EHS Manual is to be used in parallel with our customer's EHS Manual when there is one used at the site. Any differences that are identified between the First Solar Site EHS Manual and our customer's manual shall be brought to the attention of your Site Supervisor and First Solar's Safety Coordinator. The manual identified for use at the site where the work is being performed should be the one used until resolved.

4 RESPONSIBILITY

4.1 Chief Executive Officer

The Chief Executive Officer is responsible for providing the entire First Solar organization independent oversight and support in technical related areas, including Safety, Quality Assurance, and Training.

4.2 Company Executive Levels

The highest organizational level of each company (e.g., President) is responsible for establishing the specific requirements concerning safety orientation and training at each respective First Solar work site and is responsible for the overall implementation of this program.

4.3 First Solar Site Manager/Designee

The First Solar Site Manager/Designee at each job location is responsible for implementing this program, to the level required, at the job location. At the discretion of the Manager, elements of the program (e.g. training) can be designated to other individuals. The First Solar Site Manager/Designee:

- + Is responsible for conducting and documenting New Associate Safety Orientation.
- + Is responsible for establishing when and how Safety Meetings are conducted in conjunction.
- + Is responsible for ensuring Accident Investigations are conducted in accordance with corporate procedures and that corrective actions are implemented.
- + Shall report results of investigations to Client representatives if requested.

4.4 Site Safety Representative (collateral duty)

The Site Safety Representative will assist the First Solar Site Manager/Designee in assigned safety related matters.

4.5 Supervisor/Foreman (Craft contracts only)

The Supervisor/Foreman is responsible for the safety of workers under his or her supervision. The Supervisor should ensure that all Associates under their supervision have the personal protective equipment for the job. The Supervisor will:



- + Take immediate steps to correct any violation of First Solar or Client safety rules. Notification to the Client representative will be made immediately of unsafe work conditions and occasion of work stoppage.
- + Work will continue when the corrective action has eliminated or controlled the hazard or violation.
- + Not perform or direct the performance of any work that he or she feels is unsafe.
- + Only assign workers to jobs that they are capable of accomplishing safely.
- + Ensure defective tools and equipment are tagged and/or removed from service.
- + Conduct a prompt investigation of every injury, exposure to occupational illness, or "near miss" involving First Solar personnel under their supervision.

Supervisory personnel/designee placed in charge of any work will be held accountable for the enforcement of all safety rules and regulations for that project. Notify the First Solar Site Manager/Designee when an Associate has physical conditions requiring accommodation.

4.6 *Individuals*

All First Solar Associates and Contractors are responsible for complying with this program, as well as customer safety programs, in order to assure their own safety and the safety of their co-workers.

Associates and Contractors:

- + Are required to immediately report all injuries, exposures to occupational illnesses, and "near misses" to their supervisor.
- + Shall immediately report to their supervisor any unsafe condition, tool, equipment, material, or act.
- + Shall request instructions from their supervisor whenever they are in doubt as to the proper procedures for a task. No Associate should undertake any job for which they have not received adequate or required training or for which they are not fully qualified to do.
- + Shall properly wear and use all personal protective equipment (PPE) for a given job.
- + Shall coach fellow workers who are using questionable or unsafe work practices.
- + Shall inform Site Manager/Designee of any physical conditions, impairments or injuries (regardless of where the injury occurred, e.g. onsite or offsite) requiring accommodation, medication or that may affect ability to perform required duties.

Should an Associate / worker feel the work being performed is in violation of any OSHA regulation; that he or she is not properly protected; or that the work is being performed in an unsafe manner, the Associate / worker shall immediately bring the matter to the attention of his or her supervisor or First Solar Site Manager/Designee.

Any Associate / worker who deliberately violates a safety rule, procedure or standard, whether it be OSHA's, First Solar's, or the customers, or acts in such a manner as to endanger his or her own or another person's personal safety shall be subject to disciplinary action, up to and including termination.

5 NEW ASSOCIATE ASSOCIATE SAFETY ORIENTATION

5.1 Requirements

All Associates and contractors will be given a copy of the First Solar Site EHS Manual. New Associates at some locations will participate in a New Associate Safety Orientation session. At other sites Associates will be given a copy of the First Solar Site EHS Manual, and will be given an overview of the manual by the First Solar Site Manager/Designee. All Associates will have the opportunity to ask questions of the First Solar Site Manager/Designee or the Home Office.

Any unique hazards that exist at an individual work location will also be discussed during the safety orientation.

No work shall be performed until the Associate has received a safety briefing and has read & signed this manual.

5.2 Documentation

All First Solar Associates and contractors are required to sign the acknowledgement page, give it to their First Solar Site Manager/Designee, and maintain the Site EHS Manual for future use.

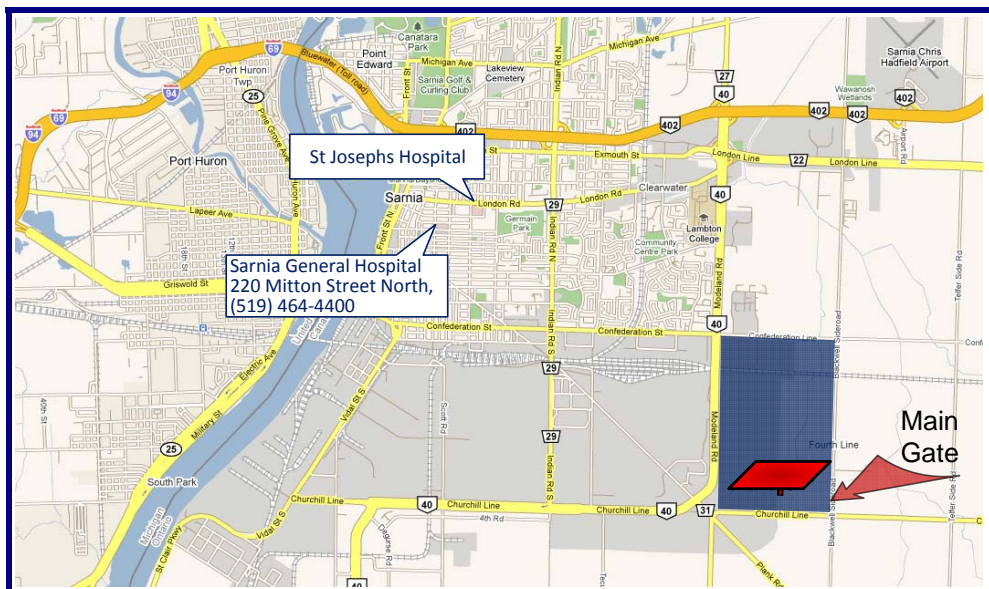
6 ACCIDENTS, INJURIES AND NEAR MISSES

6.1 Response to Injuries and Medical Emergencies

In the event of a worker injured or ill, immediately Contact a supervisor/foreman and request assistance. Call for an appropriate emergency responder. Preferably a qualified first aid trained employee. If there is doubt about the extent of the injury, for example, unconsciousness or excessive bleeding, call 911 to get an ambulance to the site.

6.2 First Aid Response

If the injured person is mobile and stable, the Supervisor or First Aid personnel may decide to bring him to the local medical service in Sarnia (Sarnia General Hospital, 220 Mitton Street North, Sarnia). Alternate choice is St Joseph's Hopstal. Both Locations are shown on the map below.





If the Supervisor decides hospital care is required, the person will be escorted to the Hospital in Sarnia.

If an ambulance is required, a company vehicle must be positioned at the site entrance or on the road side to meet the ambulance and act as a guide vehicle. The location of the entrance to each site and its emergency sign number will be available on each site vehicle.

Each vehicle is equipped with a Fire Extinguisher.

6.3 Accident Reporting

It is the workers responsibility to report ALL accidents, injuries and near misses to their First Solar Site Manager/Designee and, where applicable, to the Client designated contact.

It is a workers responsibility to report and the supervisor's responsibility to document each incident and forward the report to the First Solar Site Manager/Designee.

- + All accidents must be reported immediately to the on-call manager at (602) 384-9599.
- + All accidents will be reported by the on-site supervisor to: Stephen Nagy (519) 490-5161.
- + All accidents will be reported by Stephen Nagy to the Director of Operations for investigation.

All Accident investigations, if the responsibility of First Solar per client agreements, will be performed in accordance with Sections 6.4, 6.5, and 6.6.

FAILURE TO REPORT AN INCIDENT WITHIN TWO HOURS MAY LEAD TO DISCIPLINARY ACTION.

6.4 Supervisor Accident Investigations Requirements

All incidents where a First Solar Associate or contractor is injured, exposed to an occupational illness, or involved in a "Near Miss" will be investigated by the Associate or contractor's immediate supervisor. In incidents where the supervisor is involved or a non-work related relationship (e.g. family member) exists, a third party investigation will take place. A "Near Miss" is defined as an incident that did not cause an injury or exposure to an occupational illness but had the potential to do so.



6.5 Supervisor Accident Investigation Report

The investigation will be completed using the “*Root Cause Investigation*” Figure 1 - , “Accident Injury/Near Miss Management Form”. The investigation should be completed within 24 hours of the accident. The supervisor should conduct the investigation in such a way as to determine the root causes of the incident. Unsafe acts, unsafe conditions, and contributing factors should be the focus. Associate and witness statements should be included with the investigation. The supervisor should devote an equal amount of time in considering and recommending corrective action to prevent a re-occurrence as is used to determine the root causes.

6.6 Accident Investigations Documentation

A copy of the Accident Injury/Near Miss Management Form will be kept on file. The original should be forwarded to the Site Manager in the next scheduled overnight delivery for regulatory reporting, workers' compensation, and trend analysis purposes.

7 HOUSEKEEPING / ORDERLINESS

Prior to entering a work location, Associates should **STOP** to observe the work area and make note of any hazards, or conditions that may have changed since their last entry.

- + Scrap, trash and other wastes shall be placed in the appropriate designated containers.
- + Hazardous Waste shall be placed in containers specifically designated for that material.
- + Areas shall be cleaned up as the work progresses.
- + Cords and hoses will not be routed in walk ways . They should be routed, preferably overhead, in a manner that will not present a tripping hazard.
- + Tools and equipment shall be properly stored in a stable position (tied, stacked or choked) to prevent rolling or falling.
- + Cleaning materials and consumables will be kept in approved containers and stored properly.
- + Safe access to all work areas and emergency exits shall be maintained.
- + Do not block emergency equipment, electrical disconnect switches or breaker panels. Cables, ropes, barricade tape, hoses, or shielding shall not be attached to such equipment.
- + Work areas shall be checked at the beginning and end of each shift to ensure safe conditions.
- + Work areas shall have adequate lighting.

Personnel must take responsibility for identifying deficiencies by reporting them promptly to their immediate supervisor or by fixing the deficiency. Simply stating the problem that exists is unsatisfactory. Be part of the solution!



8 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) such as safety glasses, hard hats, earplugs, etc., cannot in themselves protect you from all harm. However, accompanied by a good safety conscious attitude, good housekeeping, and good supervision, the probability of an injury is greatly reduced. The proper equipment and good supervision will be provided.

YOU MUST PROVIDE THE SAFETY CONSCIOUS ATTITUDE.

All Personal Protective Equipment (PPE) shall be maintained in a sanitary and reliable condition. Damaged or otherwise unserviceable PPE will be properly disposed of and replaced. Contact your supervisor or First Solar Site Manager/Designee immediately for replacement of defective or damaged items.

Personnel will be trained and must demonstrate that they understand the following:

- + When PPE is necessary;
- + What PPE is necessary;
- + How to properly adjust, wear and use PPE;
- + The limitations of the PPE;
- + Care, maintenance, useful life and disposal of PPE.

8.1 First Solar Provided Equipment

First Solar PPE typically includes hard hats, safety eyeglasses, hearing protection, and work gloves, unless specified elsewhere. These items may be obtained by contacting your supervisor or First Solar Site Manager/Designee.

8.2 Reimbursement

At some sites First Solar will reimburse Associates up to a certain amount on the purchase of approved protective footwear, and prescription safety eyeglasses. Please refer to the specific site policy for the correct reimbursement guidelines.

8.3 Clothing

Loose clothing or jewelry is not permitted in work areas with machines or equipment with moving parts.

Flame Resistant Apparel (FRA) of at least Cat. 2 including a shirt covering the shoulders and trousers covering the legs and ankles shall be worn at all times

Arms - When working in the vicinity of energized lines or equipment (both high and low voltage), on high temperature lines, grinding, welding, or other high exposure hazards to the arm, full-length sleeves shall be worn.

Legs - Workers should not have cuffs on trousers when welding or performing any job that produces sparks.



8.4 Head

Hard hats in good condition and worn properly, shall be worn under the following conditions:

- + Any area posted as a hard hat area
- + Beneath any overhead work (e.g. below ladders, scaffolds, open gratings, or any other openings)
- + In any other area where head-bumping hazards exist

Protective headgear shall be worn following the manufacturer's guidelines. Headgear should not be reversed with the brim in the neck. (For welding operations obtain headgear designed for that purpose)

Users should periodically clean hard hats with soap and water and inspect them daily, prior to use, for cracks/penetrations and that the suspension system is in good condition.

Company name and Associate name should be on the hard hat.

Do not mark up or deface hard hats

Only company provided stickers can be placed on the shell of the hat

Utilization of face shields, flashlights, or hearing protection is acceptable using standard fastening devices, following the manufactures guidelines and instructions.

Any Associate who normally works where head protection is not required shall comply with these rules when entering an area where protective headgear is required.

8.5 Eyes

Safety glasses with side shields, goggles, full-face shields, and burning goggles shall be worn as necessary for the work being performed. Before beginning work, every Associate should determine the location of the nearest first aid station.

- + All safety eyewear shall be inspected prior to use for damage and scratches that could impair vision.
- + Glasses - each affected Associate who wears prescription lenses should wear safety eyeglasses that incorporates the prescription in its design or should wear safety eyeglasses that can be worn over eye prescription lenses without disturbing the proper position of the prescription lenses.
- + Contact lenses do not provide eye protection, and safety glasses shall be worn with them when eye protection is required.
- + Safety Glasses with dark lenses shall not be worn indoors or in poorly lit areas. Consult local site requirements for additional clarification.
- + Only non-vented safety goggles shall be used while working with chemicals.

8.6 Hands

Wear gloves when performing work that could result in cuts or slivers to the hand or pinching hazards exist. In all cases gloves appropriate to the job being performed will be worn unless the task cannot be completed wearing gloves or they pose a greater hazard (i.e., while operating rotating equipment).

Note: If you have allergies to latex, notify your supervisor for a substitute

8.7 Foot

Associates shall wear suitable industrial grade work shoes in good condition while working.

The following will apply in the absence of an individual site shoe policy.

- + Shoes with hard soles and leather uppers will be worn for field and shop work.
- + Approved steel toed shoes will be worn in areas where mechanical, electrical, or construction work is being performed or areas where there is an increased risk of foot injury. Your site supervisor will advise if your work area applies.

To help support ankles, high top shoes with laces should be worn by workers whose normal work requires climbing of poles and steel structures.

Footwear such as sneakers, loafers, moccasins, and canvas top shoes are not suitable work shoes for physical work environments.

8.8 Ears / Noise Exposure

Hearing protection shall be worn in areas where noise levels exceed an 8 hour time weighted average of 80 decibels, or where posted.

Note: If you or someone else needs to raise their voice level to be heard you should be wearing hearing protection. (Normal conversation is 50-60 decibels)

Use Manufacturer's instructions for inspection, care and proper usage of hearing protection.

Hearing protection will be worn:

- + In all posted areas.
- + When operating equipment or tools that produce a sound exceeding 85 dBA, even if the work area does not require it.
- + When any risk of noise exposure exists.

Double hearing protection is required where noise levels have the potential to exceed 100 dBA.

There are almost 300 different makes of hearing protectors, the right one for you depends on the amount of protection you need.

8.9 Heat Stress

Precautions include:

- + **Hydration** - drink plenty of water or sport drinks before and during work in high temperature areas. Avoid caffeine.
- + **Awareness** - be aware of your mental and physical condition at all times. If you begin to suffer symptoms of heat stress (e.g. light headedness, muscle cramps, nausea, dizziness) leave the area immediately. Observe your coworkers and be aware of any signs they may exhibit of heat stress also. Seek relief in cool shaded areas, hydrate and obtain medical assistance if symptoms are severe or persistent.
- + Utilize safety devices and procedures, including fans, barriers to block radiant heat, cool suits and designated cool zones, where temperatures are lower.

8.10 Cold Stress

Precautions include:

- + Employees are not expected to be exposed to extreme cold temperatures unless they work during cold weather for extended periods. Cold injuries are classified as either localized (such as frostnip, frostbite), or generalized as in hypothermia (a lowering of the body's temperature)
- + **Additional Clothing and Equipment** - Hard hat liner, hand warmers, insulated gloves.
- + Limit the amount of time exposed to cold weather work conditions and be aware of the symptoms of cold related illness (See the following table).

Cold -Related Illness	Symptoms	First Aid
Frostnip	<ul style="list-style-type: none"> ▪ Firm, cold, white areas on the face, ears or extremities; ▪ Peeling or blistering that may appear similar to sun burn ▪ Mild hypersensitivity to cold persist 	<ul style="list-style-type: none"> ▪ Warm the area with an unaffected hand or a warm object. ▪ Do not use hot water
Frostbite	<ul style="list-style-type: none"> ▪ The area is cold, hard, white and anesthetic; ▪ On warning is becomes red, swollen and painful; 	<ul style="list-style-type: none"> ▪ Notify EMS as soon as possible or be prepared to transport victim to a medical facility, even after treatment of frostbite. ▪ Make sure there is no risk of re-freezing. Skin that re-freezes after thawing will have more damage. ▪ Remove victim from cold environment, ensure there is no possibility of hypothermia. (If there is, see below.) ▪ Fill a shallow container with enough water to cover the frostbitten body part. Make sure the water is at room temperature. The water does not have to be cool, but it cannot be too warm. The warmer the water, the worse the pain. ▪ Immerse the injured area, ensure that the skin does not come into contact with anything! ▪ Repeat the above step by refreshing the water as it cools until the skin is back to a normal color and texture. This may take several hours depending on the severity of the injury. ▪ Remember to transport the victim to a medical assistance for further assessment after the above steps.
Hypothermia	<ul style="list-style-type: none"> ▪ Common signs to look for are ▪ Shivering, ▪ Slurred speech ▪ Abnormally slow rate of breathing ▪ Cold, pale skin ▪ Fatigue, lethargy or apathy 	<ul style="list-style-type: none"> ▪ Remove the victim from the cold environment. ▪ For cases of extreme hypothermia, where the patient is showing signs of confusion, slurred speech, fumbling hands, or go unconscious, notify EMS. ▪ Remove any wet clothing from the victim and replace with dry clothing. (A dry hat is recommended to be worn.) ▪ Wrap victim in blankets. ▪ Use heat packs to warm the patient. Do not allow the packs to touch naked skin. ▪ Victims who are Alert may drink warm liquids, however, do not give any drinks containing alcohol, caffeine, or give a drink that is too hot.



9 MATERIAL HANDLING AND STORAGE

Material shall be stacked, stored, or positioned so it does not create a falling hazard and can be reached safely by personnel and material-handling equipment. All protruding nails, wires and ragged metal edges shall be removed or hammered flush before handling.

9.1 Lifting

Never try to lift something that is too heavy. Check for stability by testing the weight carefully either by pushing or lifting at one of the corners.

Proper lifting techniques shall be observed at all times.

- + Make sure you have a clear path to carry the load, and a place to set it down.
- + Bend the knees, place your feet close to the object and center yourself over the load.
- + Get a good hand-hold.
- + Lift straight up, smoothly, and let your legs do the work, not your back!
- + Exhale as you make the lift.
- + Do not twist or turn your body while carrying the load.
- + Set the load down slow and controlled.
- + Always push a load on a cart or dolly, do not pull it.
- + If it's a long load or awkward, get additional help.
- + Split the load into several smaller ones when you can.

10 PHOTOVOLTAIC ARRAY SAFETY

Safe work habits and a clean work environment will greatly reduce the chance of personal injury and property damage. The solar module assemblies used on your system weight approximately 27 lbs.

- + Special care and the use of Kevlar gloves to protect employee's hands from cuts should be observed
- + Photovoltaic (PV) modules upon exposure to light will generate a potential (voltage).
- + All manufactured module cables and wiring harnesses have Finger Safe Connectors.
- + A single First Solar module has a potential to produce an open circuit voltage in excess of 90VDC.
- + Solar photovoltaic modules when connected in series have a potential of producing an open circuit voltage in excess of 500VDC.
- + **Never disconnect a module under load**, the entire system should be taken off line and locked out until the sub-array or module is isolated from the system.
- + Personal injury or damaged material can cause project delays that can be prevented by using "good judgment" when working or handling any PV equipment.
- + In the event that the module is damaged after being placed into service there is a high potential of electric shock. **This applies only to commissioning staff after they take control of**



- the system after the fuses are installed. Special consideration should be taken in removing and handling a damaged solar photovoltaic module.
- + It is recommended that employees wear a “dielectric” hard hat any time they are working under an array or on a system with hardware higher than their head.
 - + **NEVER** Try to pull or change any fuse or connection not rated for circuit interrupt without first disconnecting the circuit. The following items are not rated for circuit interrupt:
 - + Source Circuit Combiner Box Fuses and Blades.
 - + Multi-Contact Connectors in the Sub-Arrays.
 - + Output Circuit Wiring.

11 BLOOD-BORNE PATHOGENS

Human blood and bodily fluids contain micro-organisms that can transmit serious diseases such as AIDS and Hepatitis B. The seriousness of these diseases requires that we take special precautions and have training prior to being involved in the handling or clean up of these fluids.

Clean up and removal of blood and other body fluids will be done by trained personnel only.

Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids will be considered potentially infectious materials and handled by trained personnel only.

Notify your supervisor and medical personnel of an exposure incident as soon as possible.

12 HAZARDOUS ENERGY CONTROL

Lock Out and Tag Out are two different methods used by our First Solar and our Clients to protect you and co-workers from potential dangers in the workplace. This is accomplished by establishing a safe work boundary. This isolated boundary allows you to perform your work activity safely while controlling hazards that can be in the form of electricity, compressed or pressurized gases, steam or harmful liquids. It also protects you from inadvertent start-up of rotating equipment and mechanical force.

The Lock Out method utilizes a physical and mechanical means, an assigned numbered lock that physically controls the isolation device position and a key held by the individuals performing the work activity. The lockout tagout method used is the Utility Worker Protection Code.

The Tag Out method utilizes color-coded tags that give instructions. This is considered an administrative means to control hazards that requires procedures and must offer the same level of protection as the Lock Out method. Some plant equipment does not have a physical means to be locked out in a safe position. This is when the Tag Out method is utilized. In some cases, because of the complexity of the systems and to maintain control, the First Solar or the Client will use the Tag Out method.

- + Always ensure that tagging has been verified **PRIOR** to starting a work activity.
- + Never tamper or change the position of a Locked Out or Tagged Out device without proper authority.
- + Never remove a component or piece of equipment that has a Lock Out or Tag Out device attached.



- + Systems, equipment and electric circuits shall be de-energized and rendered safe whether utilizing Lock Out or Tag Out, prior to commencement of work activity.
- + All Associates working on rotating equipment or Electrical equipment shall be trained in Lock Out and Tag Out procedures.
- + First Solar and/or the Client will have Lock Out and Tag Out procedures in place at their facilities. First Solar personnel working under Client Lock Out and Tag Out must be trained in the Client's hazardous energy control procedure.

13 CONFINED SPACES

Non-Permitted Confined Space is a space with minimal risk or hazard without restricted access or exit point.

Permitted Confined Space is a confined space that has the potential to contain greater hazards with limited or restricted means of entry or exit and is large enough for an Associate to enter and perform assigned work, but is not designed for continuous Associate occupancy.

- + Confined space entrants, attendants, and entry supervisors are required to be trained in their respective responsibilities, in accordance with OSHA 1910.146, before performing activities related to a confined space entry.

14 SCAFFOLDS

Only competent and trained personnel shall direct the construction, modification and removal of scaffolding.

Scaffolding built above walkways and passageways shall be constructed in a manner that prevents falling object hazards to people below.

Workers shall not be exposed to a fall hazard while constructing scaffolding.

Scaffolds must be tagged indicating it is safe to use. Scaffolds that are incomplete or unsafe for use shall be red tagged accordingly and shall **NOT** be used.

Ladders or makeshift devices shall not be used on a scaffold to increase the height of the work area.

Tools and materials shall be lowered and raised in tool bags. **NO** material shall be dropped or thrown from one worker to another.

When erecting or dismantling scaffold near an energized source, the source shall be de-energized, tagged and locked out prior to the start of work. Personnel and material should be refrained from being within 10' of an energized source.

Guardrails, midrails, toe-boards or equivalent (i.e. safety netting) shall be installed on all open sides and ends of scaffolds which are 4 feet or greater in height (midrails and toe-boards are not required at the entrance to the scaffold).

When the distance from the ground to the lower platform of a scaffold is more than 4 feet, access to the platform via a ladder shall be provided. Ladders shall extend a minimum of 3 feet above the platform.

Cross braces as a means of access are prohibited.



Do not overload the designed weight load of the scaffold. If there is a question, contact the competent qualified individual responsible for the scaffold.

Scaffolds shall be kept cleared of all tools, materials and rubbish. The work area should be clean and orderly at all times.

15 HAZARD COMMUNICATION

All personnel shall be familiar with the hazards of all chemicals in the work place per OSHA regulations.

All chemicals shall have appropriate labeling. At a minimum labels will:

- + Contain the identity of the hazardous chemical(s)
- + Have appropriate hazard warning, or alternative words, pictures, symbols, or combination thereof, which provides at least general information regarding the hazards of the chemicals, in conjunction with the Hazard Communication Program
- + Provide Associates with the specific information regarding the physical and health hazards of the chemical
- + Have a corresponding number that matches the MSDS number

Materials transferred from the original container into another container should have a label immediately affixed to the new container by the person making the transfer. If a material is unknown due to a missing label, the Associate should contact their supervisor and/or the site safety representative to have the material identified. If the material cannot be identified it should be properly disposed of.

Water should be labeled as either potable or non-potable.

15.1 Chemical Handling

Employees should be informed of any chemical substances that may be present in their work environment and be made aware of potential effects on their health.

Workers must use proper procedures in the safe handling, use, storage, production and disposal of chemical/hazardous substances.

Workers must be trained for an emergency and understand the necessity of prompt application of first-aid in case of contact with flammable, poisonous, corrosive, or otherwise hazardous agents.

Suitable apparel and personal protective equipment must be worn when handling chemicals.

Keep chemical storage cabinets closed and locked when not in use. Keep lids/caps of chemical containers tightly closed when not in use, to prevent spillage of the Materials.

15.2 Working with Oil

Avoid inhalation of mist and vapor.

There are no special requirements for respiratory protection under normal conditions and with adequate ventilation.

Protective clothing must be impervious to oil.

Avoid prolonged or frequent skin contact. Do not wear contaminated clothing.

Avoid eye contact. Use eye or face protection.

Practice good personal hygiene.

15.3 Material Safety Data Sheets (MSDS)

Material Safety Data Sheets shall contain:

- + Identification of the product
- + Trade Name
- + Chemical Name
- + Chemical Formula
- + Hazardous Ingredients
- + Physical Data
- + Fire and Explosion Hazard Data
- + Health Hazards
- + Reactivity Data
- + Spill and Disposal Procedures
- + Personal Protection Information
- + Handling and Storage Precautions
- + Emergency and First Aid Procedures

There is no specific MSDS format. MSDS information at your work location is available in log books. Your site supervisor will provide the location and the means to access MSDS information. The MSDS for each chemical to be used in particular job should be reviewed as part of the pre-job briefing paying particular attention to the hazards and safety precautions.

15.4 General Rating Summary

	Rating	Description
Health (BLUE)	4	Danger - May be fatal on short exposure, Specialized protective equipment required.
	3	Warning - Corrosive or toxic. Avoid skin contact or inhalation
	2	Warning - May be harmful if inhaled or absorbed
	1	Caution - May be irritating
	0	No unusual hazard
Flammability/Fire (RED)	4	Danger - Flammable gas or extremely flammable liquid
	3	Warning - Flammable liquid flash point below 100 °F
	2	Caution - Combustible liquid flash point of 100 - 200 °F
	1	Combustible if heated
	0	Not combustible
Reactivity (YELLOW)	4	Danger - Explosive material at room temperature
	3	Danger - May be explosive if shocked, heated under confinement or mixed with water
	2	Warning - Unstable or may react violently if mixed with water
	1	Caution - May react if heated or mixed with water but not violently
	0	Stable - Not reactive when mixed with water
Special Notice (WHITE)		
	W	Water Reactive
	OX	Oxidizing Agent

All spills shall be contained, immediately reported to the First Solar Site Manager/Designee, and then promptly cleaned up. Only properly trained workers using appropriate PPE are authorized to clean up any spill.

16 SIGNS AND TAGS

Observe, read and obey all signs and postings. If it becomes apparent that a situation or area warrants the need for a sign or posting, notify your supervisor immediately. Hazard warning (e.g., Safety) signs must conform to the following color-coding systems:



16.1 Color Codes

- + **SAFETY RED** identifies **FIRE, DANGER, or STOP**. It is most commonly used in flammable liquid identification, emergency stop switches, and fire protection equipment. Danger indicates an immediately hazardous situation that could cause death or serious injury.
- + **SAFETY ORANGE** indicates **WARNING**. Orange identifies hazardous equipment or situations. Common uses include marking machine hazards that pose cut crush, or pinch injuries, and for marking the insides of movable guards that allow access to gears, chains, and the like. Warning indicates a potentially hazardous situation that could result in death or serious injury.
- + **SAFETY YELLOW** denotes **CAUTION**. Used with black lettering, yellow identifies hazards such as conditions that might result in tripping or falling or flammable material storage. Caution indicates a potentially hazardous situation that may result in moderate injury.
- + **SAFETY GREEN** denotes **SAFETY**. Green identifies the locations of safety equipment material safety data sheets, and first-aid equipment.
- + **SAFETY BLUE** indicates **NOTICE**. It is the color that identifies safety information signs such as personal protective equipment requirements.
(It also has some specific uses in the railroad industry).

16.2 Tags

Compliance in all situations where tags are utilized requires stopping and reading specific instructions on the tag. Any questions about the wording on the tag should be directed to your Site Supervisor.

17 EQUIPMENT / TOOLS

All necessary tools and equipment, including PPE, shall be properly maintained and shall be appropriate for the safe accomplishment of the task. Associates shall be properly trained or otherwise qualified to use tools and equipment.

All tool, equipment and PPE shall be used for the purpose they are intended. Modifications shall not be made without written approval from the manufacturer and the Contract Administrator.

All tools and equipment shall be kept in good operating condition; sharp, clean, oiled, dressed, etc. Tools must be returned to the designated area when no longer needed or if they are in need of repair.

17.1 Hand Tools

Do not force tools beyond their capacity. Know the limitations of the equipment and do not exceed them.

Do **NOT** use tools or equipment for anything other than its intended purpose.

Do not carry pointed tools in pockets.

Always use safe equipment. It is the responsibility of the user to inspect equipment before using it. If the equipment becomes defective in any way, place a "Defective - Do Not Use" tag on it and take it out of service.



17.2 Power Tools

Loose clothing, long hair that is not secured, gloves, rings, and other jewelry shall not be worn around rotating equipment. Sleeves shall either be kept buttoned or rolled up.

Power tools shall **NOT** be operated without proper training and instructions.

Each power tool shall be inspected before use for damaged parts, loose fittings, and frayed or cut electrical cords. Defective tools must be tagged and taken out of service.

Interlocking devices shall be in good working order and never bypassed.

All tools shall be used with the correct shield, guard, or attachment recommended by the manufacturer.

Machines shall be shut off and brought to a complete stop before removing waste.

Personnel are expected to return all tools and equipment to the appropriate tool room or gang box upon completion of use. Anyone failing to do so may be required to pay for missing items. Personnel removing First Solar or Client tools or equipment from site without proper approvals shall be terminated.

17.3 Knives

Pocket knives will not be used at the work site.

Razor knives are rarely the appropriate tool for completing an assigned task. Tools such as scissors, side-cutters, snaps or scrapers are normally more appropriate and present less risk to the individual using them.

Razor knives, box cutters, etc. require the prior approval of the First Solar Site Manager/Designee before use.

Leather or cut resistant gloves must be worn when the use of a razor style knife has been approved.

18 WALKING / WORKING SURFACES

Good housekeeping is fundamental and essential for the prevention of accidents due to slips, trips or falls, and fires. All work areas, passageways, storerooms, and service rooms must be kept clean, dry, orderly and in a sanitary condition.

DO NOT block exit doors, access to fire extinguishers, automatic sprinkler risers or emergency lights.

19 GUARDING FLOOR AND WALL OPENINGS AND HOLES

All holes or openings through floors or decking at all elevations shall immediately be provided with hole covers or barricades.

Material and equipment shall not be stored on a hole cover.

19.1 Hole Covers

Shall have an attached sign or labeling indicating it is a temporary cover and not to remove it unless authorized.

Shall be cleared, wired, or otherwise secured so it cannot slip off of the hole.

Shall extend adequately beyond the edge of the hole.

19.2 Barricades

Anyone who creates a hazard is responsible for having it barricaded.

Types of barricades:

Warning Barricades - Warning barricades call attention to a hazard but offer no physical protections. Example: caution tape, plastic fencing, saw horse type barricade.

Protective Barricades - Protective barricades warn as well as provide physical protection and shall be able to withstand 200 lbs of force in any direction with minimal deflection. Examples: wooden post and rail, cable, wooden post and metal chain.

Barricades are required around excavation, holes, openings in floors, roofs, elevated platforms, overhead work, and wherever necessary to warn people of falling or tripping hazards.

- + Barricades shall be 42 inches high and maintained square and level.
- + Warning barricades may be placed 5-6 feet or more from the hazard.
- + Protective barricades may be placed closer but when used around a fall hazard they must have a mid-rail as well as the top rail.
- + Barricade signs shall be fully informative, legible and visibly displayed.

19.3 Addressing Fall Hazards

When performing any task that would allow you to fall four feet or more, or any distance where a likelihood of serious injury or death exists, the following will be utilized:

Fall Prevention - proper fall prevention utilizes alternatives that eliminate a hazardous situation and therefore removes the chance of a worker's exposure to a fall such as:

- + Use of a harness, non-shock absorbing lanyard and approved tie off point that prevents an Associate from getting to within six feet of drop off fall hazard.
- + Physical barriers that prevent exposure to fall hazards.
- + Use of scaffolding to perform work activity.

Fall Protection - is required when a hazardous condition cannot be fully or adequately eliminated. Fall arrest equipment and procedures are then needed. ***Training must be obtained before fall arrest equipment can be used.*** See site-specific requirements.

- + Fall arrest equipment minimizes the detrimental effects of a fall should it occur. Fall arrest equipment should consist of a full body harness, shock absorbing lanyard, self-locking snap hooks, and adequate anchorage points. Training must be provided before fall arrest equipment can be used.
- + If there are any questions about the adequacy of an anchor-point, obtain an engineering opinion.



20 LADDERS

20.1 *Portable Ladders*

Never exceed the rated capacity of the ladder.

The user shall inspect the ladder before using it. Any ladder found to be defective will be removed from service and tagged as deficient.

While ascending and descending a ladder your face will be toward the ladder, hold on with both hands.

Always use a hand-line to raise and lower materials.

While working on a ladder, do not extend your reach, your beltline should be within the side rails of the ladder.

- + Change the position of the ladder as often as necessary to stay within the reach of your work.
- + If both hands are required to perform a task, fall protection must be worn and properly anchored.
- + Keep your feet on the rungs; do not put your feet on surrounding material.

Under no circumstances should chairs, furniture or any other item with a different intended use be utilized as a ladder.

If it is necessary to place a ladder in or behind a doorway, barricade the work area and post warning signs on both sides of the door.

20.2 *Straight or Extension Ladders*

Every ladder shall be equipped with a tie-off rope and non-skid safety feet.

Every ladder shall be adequately tied-off or footed by another Associate.

If a ladder is used to access an elevated work area, the top of the ladders shall extend at least three (3) feet above the supporting object.

Once an extension section of a ladder has been raised to the desired height, ensure the safety latches are engaged and the extension rope is secured to a rung on the base section of the ladder.

The extension section of the ladder shall overlap the base section by a minimum of three (3) rungs.

20.3 *Step Ladders*

Step ladders should be set on a level surface with all four legs on the ground, with spreaders locked in place.

A step ladder will never be used as a straight ladder.

Do not sit or stand on the top of a stepladder.

On standard design step ladders over three feet high do not stand on the step below the top step.

Tie off a step ladder when using it close to the edge of a platform.



21 WELDING, CUTTING AND BRAZING

Associates must be trained in the safe operation of the equipment, comply with hot work procedures and have appropriate permits.

Inspect work area for combustible material prior to the start of work. Welding shields are to be used to prevent other workers in the area from flash or from being burned from welding slag and grinding.

If fire watch is necessary per site requirements, the fire watch must remain on duty for 30 minutes after the completion of the job.

22 ELECTRICAL

These practices are intended to be the minimum required for workers and any contractor working on site. The current Ontario Occupational Health and Safety Act (OHSA) and Regulations outline specific duties and responsibilities of employers and workers. In addition, the Electrical Utility Safety Rules published by Electrical & Utilities Safety Association of Ontario are to be used as a minimum requirement for the work place and public safety. All practices must be in conformity with OHSA and EUSA and must meet or exceed these standards at all times.

This Manual must be read and used in conjunction with OSHA and EUSA Safety Rule Book. Each Company vehicle has a copy of the OSHA manual. The EUSA Safety Rule book is maintained in the Power Plant Supervisors site office.

In some cases, contractors, business associates and customers may have supplementary safety practices already established. In those instances, the more stringent practice will prevail.

In all cases, it must be the responsibility of the supervisor to determine prior to the commencement of work that these practices are implemented and enforced.

Working on or Around Electrical Equipment

Work on exposed energized lines or equipment may be performed only by qualified individuals in accordance with approved procedures. Live parts of electrical equipment operating at 50 volts or more must be guarded against accidental contact.

Associates working on energized electrical equipment where the danger of flash or arc is present must wear appropriate fire-retardant clothing in accordance with First Solar procedures additional requirements.

Always treat electrical equipment as energized until approved testing methods prove that it is de-energized.

Electrical tools should not be used in wet conditions. As an alternative, use battery operated or pneumatic driven equipment.

Extension Cords

Extension cords are for **TEMPORARY** use only.

Inspect cords prior to use, if visible damage is present, remove it from service. Place cords so they are not damaged by doors, sharp corners, pinch points, etc.

Extension cords should be routed overhead, under grating or along the edges of wall and secured so they cannot move. When it is necessary to route a cord across a traffic area it shall be, enclosed in a cord protector or taped to the floor the full length of the section crossing the traffic area.

- + Never overload an extension cord.
- + Avoid 'ganging' or stringing multiple cords together to make a longer cord.
- + Do not alter plugs or receptacles.
- + Do not remove ground poles.
- + Should not be used in wet conditions.

23 FIRE PREVENTION / PROTECTION

All Associates shall be alert for fire hazards. They shall eliminate such hazards if possible and in all cases report them to supervision.

Know your exit route to be used in case of an emergency.

Good housekeeping is one of the most effective aids to fire prevention.











All passageways to exits should be clear without slip, trip and fall hazards.

Waste paper, rags and other combustible material should not be allowed to accumulate.

23.1 Fire Extinguishers

Fire extinguishers may be used by trained personnel only.

Associates shall become familiar with the location, type and use of fire extinguishers in their work area.

		Class A - Identified with a green triangle. For use on wood combustibles, wood, paper, textiles, and rubbish.
		Class B - Identified with a red square. For use on liquid fires, oil, gasoline, paints, lacquers, thinners, grease, etc.
		Class C - Identified with a blue circle. For use on electrical fires.
		Class D - Identified with a yellow star. For use on combustible metals such as magnesium.
		Class K – Identified as fires in cooking appliances that involve combustible cooking material. (Vegetable or animal oils and fats)



Firefighting equipment such as fire hoses, extinguishers, etc., shall not be used for purposes other than their intended purpose - fighting fires.

Exit routes and access to fire equipment **MUST** be unobstructed.

Fire extinguishers shall be recharged after use. **NEVER** replace an empty fire extinguisher to its assigned location.

24 CRANES, FORKLIFTS

Only trained and licensed personnel who have been authorized may operate cranes and forklifts.

- + Inspect equipment prior to use to ensure it is in safe operating condition.
- + Forklift forks shall be lowered to the ground before the operator may leave the equipment.
- + Raise the load only as high as necessary to safely clear the road surface when in motion.
- + Travel at safe speeds for surface conditions.
- + Ensure that a mobile crane is properly grounded when working around power lines.
- + Seatbelt shall be used if available.

25 HUMAN PERFORMANCE

Communication should be clear and concise. Keep slang to a minimum; make sure the message conveyed is the message understood. Use three way communications. Ask questions if you are unsure. Assume Nothing!

Be aware of your surroundings; take a time out to observe your work area. Be conscious of any changes.

Avoid complacency. Perform each task with awareness and a constructive attitude.

25.1 STAR - Human Performance Error Reduction

The "STAR" program has been instituted for the purpose of reducing the number of human performance related errors. The basic principles of the program are to help focus individual's attention on the task at hand and self-check that the steps of the task are executed as planned.

The STAR principal is as follows:

STOP - Ensure you are prepared for the task or job assignment. Proper tools, PPE, have read the procedures, qualified/trained to perform, etc.

THINK - Review (Procedures, Guidelines, OE's, Lessons Learned, etc.) What will be the results of your actions?

ACT - Perform Task.

REVIEW - Review results, document successes and lessons learned.

26 BONUSES, AWARDS AND PROMOTIONS

The company may grant bonuses and promotion at the discretion of the Vice President of the respective division based upon excellence in the following areas:

- + Ideas that promote safety
- + Ideas that generate new business



- + Ideas that reduce costs

26.1 Safety Suggestions

First Solar Associates and contractors have firsthand experience and knowledge of the equipment and work environments used on a daily basis. These factors frequently make our Associates our best source of ideas on how to work more safely. First Solar personnel are strongly encouraged to submit their ideas to their First Solar Site Manager/Designee.

27 NEWSLETTER

A Safety Newsletter will be published by the First Solar Home Office on a quarterly basis. The Safety Newsletter will provide information on current safety issues within the company. Each Associate at a site should receive a copy of the Safety Newsletter.

28 REPORTING OF SAFETY CONCERNS

First Solar takes great pride in providing the highest quality support services to our Clients. A vital part of performing quality work includes an ongoing responsibility for each worker to evaluate working conditions for themselves and their coworkers and to promptly report to the Client or First Solar Site Supervision any unsafe conditions or any condition which may lead to or cause a safety violation. The initial verbal report should be followed up in writing. First Solar will not fire, discipline, or otherwise discriminate against any Associate for bringing safety concerns to the attention of our supervision or utility personnel. Please also refer to the Equal Employment Opportunity Policy regarding this issue.

Our home office houses many members of management with construction, power plant and Private Industrial/ (OHSA) experience. All who are available to answer technical questions or discuss safety concerns? All questions and inquiries are kept confidential and may be made either in writing or orally.

All First Solar personnel have an obligation to cooperate in any Company or Client review or investigation of an identified concern or issue, even if they did not raise the concern or issue under investigation.

An injured First Solar Associate or contractor will immediately and directly notify the First Solar Site Manager/Designee of an injury or illness. In addition, the First Solar Site Manager/Designee will request to be notified immediately and directly, by any Client manager who is knowledgeable and made aware of the injury or illness to a First Solar Associate or contractor.

It is First Solar's policy to encourage workers to bring their concerns to First Solar Supervision on site, First Solar Home Office management or Client supervision, without fear of discrimination, harassment, intimidation or retaliation.

29 TERMS AND ABBREVIATIONS

Authorized person: means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite.

Competent person: means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to Associates, and who has authorization to take prompt corrective measures to eliminate them.



Confined Space: is a space that (1) is large enough and so configured that an Associate can enter bodily, (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, vaults, shafts, pits), and (3) is not designed for continuous occupancy.

Project Manager: is the First Solar Associate responsible for the supervision and field management of day-to-day needs of a project. It may be a project superintendent, a craft supervisor, or a lead person.

Construction work: For purposes of this section, "Construction work" means work for construction, alteration, and/or repair, including painting and decorating. **Construction:** is any combination of engineering, procurement, erection, installation, assembly, demolition, or fabrication used to create a new facility, or to alter, add to, rehabilitate, dismantle, or remove an existing facility. It also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction and excavation activities conducted as part of environmental remediation efforts..

Imminent Danger: is any condition or practice that could reasonably be expected to cause death or serious physical harm (permanent or prolonged impairment of the body or temporary disablement requiring hospitalization) to Associates or the public unless immediate actions are taken.

OHSA: Occupational Health and Safety Act.

Project Inspector: is the Facilities Department's representative responsible for monitoring project quality and verifying compliance with the terms and conditions of the design documents.

Project Manager: is the First Solar Associate representative with overall responsibility for a project. This person ensures subcontractor compliance with subcontract documents, including performance, schedule, budget, and safety.

Shall: means mandatory

Should: means recommended

Contractor: is a firm or Associate of a firm that performs work under the direction and/or supervision of a First Solar Manager, Supervisor or First Solar designated Associate. Contractors are responsible for compliance with all safety, health, and environmental codes, standards, and regulations.

Qualified Person: one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.



30 COMMON HAZARDS AND DESCRIPTIONS

Hazards	Hazard Descriptions
Chemical (Toxic)	A chemical that exposes a person by absorption through the skin, inhalation, or through the bloodstream that causes illness, disease, or death. The amount of chemical exposure is critical in determining hazardous effects. Check Material Safety Data Sheets (MSDS) for chemical hazard information.
Chemical (Flammable)	A chemical that, when exposed to a heat ignition source, results in combustion. Typically, the lower a chemical's flash point and boiling point, the more flammable the chemical. Check MSDS for flammability information.
Chemical (Corrosive)	A chemical that, when it comes into contact with skin, metal, or other materials, damages the materials. Acids and bases are examples of corrosives.
Explosion (Chemical Reaction)	Self explanatory.
Explosion (Over Pressurization)	Sudden and violent release of a large amount of gas/energy due to a significant pressure difference such as rupture in a boiler or compressed gas cylinder.
Electrical (Shock/Short Circuit)	Contact with exposed conductors or a device that is incorrectly or inadvertently grounded, such as when a metal ladder comes into contact with power lines. 60Hz alternating current (common house current) is very dangerous because it can stop the heart.
Electrical (Fire)	Use of electrical power that results in electrical overheating or arcing to the point of combustion or ignition of flammables, or electrical component damage.
Electrical (Static/ESD)	The moving or rubbing of wool, nylon, other synthetic fibers, and even flowing liquids can generate static electricity. This creates an excess or deficiency of electrons on the surface of material that discharges (spark) to the ground resulting in the ignition of flammables or damage to electronics or the body's nervous system.
Electrical (Loss of Power)	Safety-critical equipment failure as a result of loss of power.
Ergonomics (Strain)	Damage of tissue due to over exertion (sprains and strains) or repetitive motion.
Ergonomics (Human Error)	A system design, procedure, or equipment that is error-provocative. (A switch goes up to turn something off).
Excavation (Collapse)	Soil collapse in a trench or excavation as a result of improper or inadequate shoring. Soil type is critical in determining the hazard likelihood.
Fall (Slip, Trip)	Conditions that result in falls (impacts) from height or traditional walking surfaces (such as slippery floors, poor housekeeping, uneven walking surfaces, exposed ledges, etc.)
Fire/Heat	Temperatures that can cause burns to the skin or damage to other organs. Fires require a heat source, fuel, and oxygen.
Mechanical/Vibration (Chaffing/Fatigue)	Vibration that can cause damage to nerve endings, or material fatigue that results in a safety-critical failure. (Examples are abraded slings and ropes, weakened hoses and belts.)
Mechanical Failure	Self explanatory; typically occurs when devices exceed designed



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	capacity or are inadequately maintained.
Mechanical	Skin, muscle, or body part exposed to crushing, caught-between, cutting, tearing, shearing items or equipment.
Noise	Noise levels (>85 dBA 8 hr TWA) that result in hearing damage or inability to communicate safety-critical information.
Radiation (Ionizing)	Alpha, Beta, Gamma, neutral particles, and X-rays that cause injury (tissue damage) by ionization of cellular components.
Radiation (Non-Ionizing)	Ultraviolet, visible light, infrared, and microwaves that cause injury to tissue by thermal or photochemical means.
Struck By (Mass Acceleration)	Accelerated mass that strikes the body causing injury or death. (Examples are falling objects and projectiles.)
Struck Against	Injury to a body part as a result of coming into contact of a surface in which action was initiated by the person. (An example is when a screwdriver slips.)
Temperature Extreme (Heat/Cold)	Temperatures that result in heat stress, exhaustion, or metabolic slow down such as hypothermia.
Visibility	Lack of lighting or obstructed vision that results in an error or other hazard.
Weather Phenomena (Snow/Rain/Wind/Ice)	



PART 2 – SITE SAFETY REQUIREMENTS

1 SAFETY MEETINGS

1.1 Safety Meetings and Pre-job Briefs

The Weekly Safety Meeting may be used to discuss safety topics. Safety topics may be selected based on the trending data. The Weekly Safety Meeting also provides the First Solar Site Manager/Designee an opportunity to promptly discuss important safety matters. The focus will be on work activity specific to safety, quality, and Associate responsibility of each job.

The Safety Meeting should be used to inform workers about the findings of recent accident investigations, safety self-inspections, and any other pertinent safety topics. Individual workers are frequently our best source of information in learning how to work more safely, and the weekly meeting enables individuals to offer their input. Performance goals and trends identified by the First Solar Site Manager/Designee, should be discussed during this meeting.

Safety Toolbox Talks are to be conducted daily to remind, enlighten and educate personnel and reduce accidents.

(Client safety meetings can be used to meet this goal if First Solar personnel attend these Client meetings.)

1.2 Documentation

An attendance roster and notes should be maintained on file to document all Safety Meetings.

2 JOB HAZARD ANALYSIS

Careful planning of work assures that the work is performed efficiently and safely. Hazard analysis is a critical part of work planning. Work planning ensures the scope of work is understood, appropriate materials are available, all hazards have been identified, effective measures to mitigate hazards are established, and all affected employees understand what is expected of them.

All work activities shall be subjected to work planning and Job Hazard Analysis (JHA). Depending on the complexity of the task and the hazards involved, the JHA process may be a mental exercise and verbal discussion, or it may be more formal with a written hazard analysis and pre-job briefing. Written JHAs shall be performed using **Error! Reference source not found.**

Table 1 below provides guidelines to assist in making that determination when a formal JHA is required.

Table 1 Job Hazard Analysis Requirements

CATEGORY	HAZARD (JHA Required)
Electrical work	+ Work activities near or on exposed electrical conductors, circuits, or equipment that is or may be energized and where there is a significant and unmitigated exposure to electrical shock or a significant potential for arcing, flash burns, electrical burns, or arc blast.
Confined Space Work	+ Permit required confined space entry where and when hazards cannot be adequately addressed in the permit.
Crane & Hoist Usage	+ Load requires exceptional care in handling because of size, shape, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.



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CATEGORY	HAZARD (JHA Required)
Excavation and digging	<ul style="list-style-type: none"> Digging or excavating in area where the potential exists for encountering buried utilities. Employees entering excavation/trench that is > 4 feet in depth.
Hazardous substances & regulated pollutants	<ul style="list-style-type: none"> Potential for release of hazmat on-site in quantities > 50% of "Reportable Quantities" (40 CFR 302 and 40 CFR 355). Potential for release of 42 gallons or more of petroleum, fuel oil, oil refuse, and oil mixed with wastes (40 CFR Part 112.4(a)).
Chemical Usage	<ul style="list-style-type: none"> Use of materials that are flammable, combustible, corrosive, reactive, toxic, caustic, poisonous, where the quantity or manner of use is hazardous to the health of the workers, the environment, or presents a potential for fire/explosion.
Respiratory and Hearing Protection	<ul style="list-style-type: none"> Work requiring hearing or respiratory protection due to potential to exceed Permissible Exposure Limits.
Hazardous Substance Abatement Activities	<ul style="list-style-type: none"> Work involving abatement of asbestos, lead, PCBs, or mercury .
Lasers	<ul style="list-style-type: none"> Use of Class IIIB or IV lasers (FESHM 5062.1)
Working at heights	<ul style="list-style-type: none"> Fall potential is > 4 feet when performing maintenance work, and > 6 feet when performing construction work, and additional fall protection is required.
Stored Energy	<ul style="list-style-type: none"> Potential for inadvertent startup of equipment Potential for unexpected release of energy (hydraulic, pneumatic, thermal, potential, etc.) where lockout tagout is required.
Tools & Fixtures	<ul style="list-style-type: none"> In house designed or modified tools or tooling required for work activities where a tool or tooling failure could pose a risk of injury to workers. In house designed or modified fixtures used for work activities where a fixture failure could pose a risk of injury to workers.
Sharp Instruments	<ul style="list-style-type: none"> Non-routine work requiring the use of sharp instruments or cutting tools where the worker is exposed to the unguarded cutting surface.
Other	<ul style="list-style-type: none"> Working with systems or equipment which are pressurized > 15 psig. Work requiring welding, brazing, or open flames. Concrete coring and cutting when hazards cannot be adequately addressed in the JHA. Work requiring construction, altering, and/or repair, including painting and decorating. Materials being used in a state that is altered from its original form, that as a result may be is hazardous to the health of the workers, the environment, or presents a potential for fire/explosion. Activity involving a lower level hazard, but involving multiple organizations participating. Potential for job-induced alertness reduction (e.g., long hours, short deadlines). Activities presenting lower hazards, but are performed infrequently. Activities presenting hazards unfamiliar to employees. Excessive hot or cold working conditions or inclement weather.



3 PRE JOB BRIEFINGS AND WORK AUTHORIZATIONS

Regardless of whether the JHA is a mental or written exercise, the supervisor and employees performing the job shall discuss the work plan to ensure everyone is aware of how the job will proceed. For low-risk tasks the briefing may be a quick exchange between the supervisor and employee(s). For more complex and higher-risk tasks, a formal pre-job briefing is required, including a written JHA. **Error! Reference source not found.** Part 1 is completed by the person or Supervisor of the person(s) performing the job or task. The pre job briefing (Part 2) is then used by the O&M Representative to conduct the pre job briefing. The pre-job briefing shall consist of the following:

- + Summarizing the critical steps and materials.

This would include steps where the success depends solely on the individual work, and that serious injury or significant loss of property could result from not following the prescribed safe work procedures.

- + Anticipating what can go wrong or where errors can occur.

This would include distractions, confusing procedures, inexperience and assumptions. Examining what errors have occurred with the activity in the past may be helpful.

- + Foreseeing consequences

What is the worst that could happen? Work plans should incorporate defenses to prevent the incident.

- + Review operating experience.

How has the task gone in the past? Work plans should incorporate defenses to prevent a repeat incident. The SSO is a good informational source in this area.

- + Review of Equipment

Review of PPE, equipment necessary for the job, engineering controls, and equipment controls.

All who review the written Pre Job Briefing and Work Authorization will document the review by signing the form. Only then will the supervisor allow the work to begin.

Work Performance

The work Authorization and JHA shall be posted in the work area or shall be readily available to those performing the work. Any visitors to the job site must also review and sign a written JHA.

The work activity must be completed in accordance with the Work Authorization and the JHA. If there is a change in the work scope, if work conditions change or if new hazards are identified, or the controls prove inadequate or ineffective, the work activity shall cease immediately. The Work Authorization and the JHA shall be reviewed by the employees and supervisor, revised as necessary, and approval/concurrence obtained from O&M before the work is continued.



Post Job Review

After the activity has been completed, the Work Authorization and the JHA should be updated to include improvements that were identified while performing the work. This will help assure better planning and a safer work experience the next time the job has to be performed.

Work Authorization and JHA Record Retention

The Power Plant Supervisor will keep a copy of the JHA for one year. These will be made available to the FS Safety organization or anyone who requests them, for the purposes of providing oversight, trending, and/or lessons learned. In general, Work Authorization should be kept on file for 1 year.

4 MONTHLY SAFETY INSPECTIONS

Safety inspections will be performed monthly and after significant storms or rainfall events by Operations and Maintenance personnel using the **Error! Reference source not found.** to ensure compliance with First Solar safety standards. A work order shall be initiated for any deficiencies identified that are not corrected during the inspection. A copy of the **Error! Reference source not found.** will be kept on file. The original should be forwarded to the FS Corporate Safety Manager for and trend analysis purposes.

5 RESPONSE TO COMPLAINTS

If a complaint is received, the Power Plant Supervisor perform the following:

1. Record the nature of the complaint and all relevant information in the station operating log and attempt to resolve the complaint.
2. Notify the Director, Operations and Maintenance.
3. If necessary, schedule a visit at an appropriate time with the resident.
4. If the complaint is noise related, notify the MOE (At the address below) in writing of the resident's complaint within two business days of receiving the complaint and, as soon as possible thereafter, advise the Ministry of the actions being implemented.

Ministry of the Environment
Owen Sound Area Office
1580 20th Street E
Owen Sound, ON
1-800-265-3783
519-371-2901

6 SPILL PREVENTION, CONTROL AND COUNTERMEASURES

6.1 Purpose

This section of the EHS Manual outlines and prescribes the Spill Prevention, Control and Countermeasures (SPCC) plan for the Sarnia PV Power plant and describes the requirements for notifying the proper authorities. The SPCC Plan also describe measures implemented by First Solar to prevent oil discharges from occurring, and to prepare First Solar to respond in a safe, effective, and timely manner to mitigate the impacts of a discharge

This plan was written, in part to meet the requirements of the Ministry of the Environment (MOE) requirements for spills of pollutants to the natural environment including fixed site and transportation spills.

6.2 Scope

The SPCC includes equipment, operations and activities the Sarnia PV Power Plant with the potential to release liquid pollutants from or out of a structure into the environment which cause or may cause;

- impairment to the quality of air, water or land, or for any use that can be made of it;
- injury or damage to property or animal life;
- harm or material discomfort;
- impairment to safety;
- adverse health effects;
- property, plant or animal to become unfit for use;
- loss of enjoyment of the normal use of property; OR
- interference with the normal conduct of business

6.3 Location of SPCC Plan

A current and up-to-date copy of the Spill Prevention, Control and Countermeasures (SPCC) plan for the Sarnia PV Power plant shall be maintained at the PV Solar Plant in the office building at all times.

6.4 Spill Classifications

For the purpose of this SPCC Plan, spills are classified into the following three categories;

Level 1 – Minor

The responsible party can contain and clean up the spill with their own resources and the spill will not have significant adverse effects on fish, wildlife or water supplies.

Level 2 – Moderate

Further local resources are necessary for containment and cleanup of the spill.

The spill may result in significant adverse effects on fish, wildlife or local water.

Level 3 – Major

Other resources are required in addition to those available locally for containment and cleanup due to loss of control and containment during actions under the local plan OR;

Water supplies over a wide spread area are endangered OR;

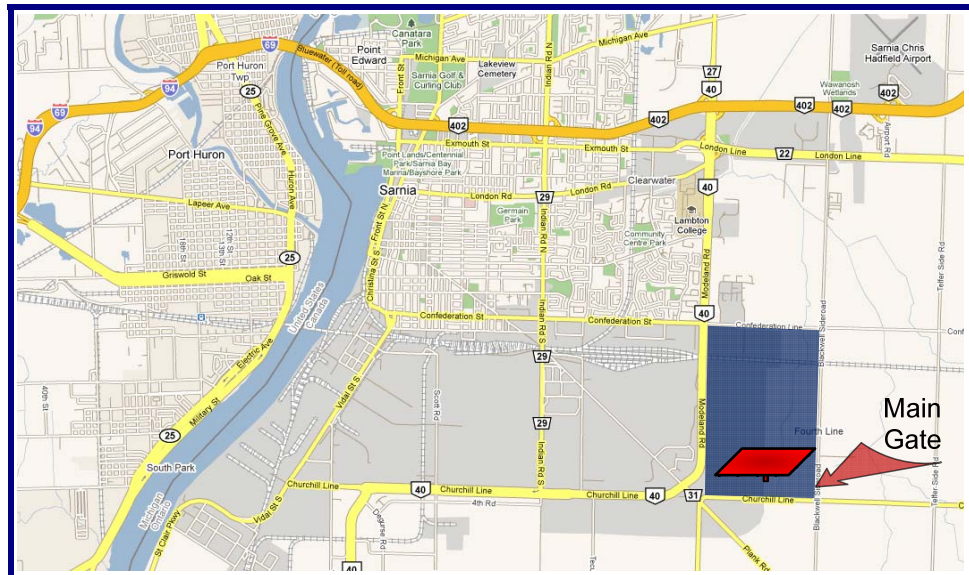
The spill potentially endangers human life or has serious adverse affects on fish or wildlife over a wide spread area OR;

The spill generates considerable public concern.

In the event of a Major Spill, the MOE will implement and coordinate District-level, Regional-level or Provincial Emergency Response Plan as appropriate.

6.5 System Description

The Sarnia Solar Farm PV Power Plant is an 80 MWe AC generating station constructed by First Solar Electric of Bridgewater New Jersey and is owned by Enbridge Corporation. The facility is located approximately 6 kilometers southeast of Sarnia, Ontario Canada and is bordered by Churchill Line, Highway 40, Confederation Street and Blackwell Sideroad.



The PV Power Plant is comprised of 8 generating blocks designated B1 through B8. Each generating block is powered from 10 individual Power Conversion Stations (PCS). A single oil filled Pad Mounted PCS Transformer is located at each of the 80 PCSs.

6.6 Changes in PV Solar Plant Configuration

First Solar periodically reviews and evaluates this SPCC Plan for any change in the PV Solar Plant design, construction, operation, or maintenance that materially affects the PV solar plant's potential for an oil discharge, including, but not limited to:

- commissioning of transformers;

- reconstruction, replacement, of transformers

- changes of product or service, revisions to standard operation, modification of testing/inspection procedures, and use of new or modified industry standards or maintenance procedures

First Solar must make the needed revisions to the SPCC Plan as soon as possible, but no later than six months after the change occurs. The Plan must be implemented as soon as possible following any changes, but *no later than six months* from the date of the amendment. The PV Solar Plant Site Supervisor is responsible for initiating and coordinating revisions to the SPCC Plan

6.7 Liquid Product On-Site

Each PCS transformer located at the site holds 1613 Liters (426 gallons) of FR3, which is vegetable based dielectric oil. The total quantity of vegetable based dielectric oil in the transformers is 129040 Liters (34089 gallons).

The pressure and level of oil in each transformer is monitored continuously via a remote monitoring system with alarms. These alarms are communicated to discharge response personnel via their mobile phones.

6.8 Spill Prevention Measures

All PCS transformers used at this PV Solar Plant are constructed of steel, in accordance with industry specifications. The design and construction of all transformers are compatible with the characteristics of the oil product they contain, and with temperature and pressure conditions



First Solar performs the inspections, tests, and evaluations at the intervals described below to ensure the integrity of the PCS transformer enclosure:

Weekly Inspections - A First Solar employee performs a complete walk-through of the PV Solar Plant each week. This weekly visual inspection involves: looking for leakage, stained or discolored soils or leaking equipment.

Monthly Inspection - A Monthly Safety Inspection is performed by First Solar personnel. The monthly inspections cover the following key elements of spill prevention monitoring:

- Observing the exterior of transformers, and other equipment for signs of deterioration, leaks, corrosion, and thinning.
- Observing transformer oil level and pressure.
- Observing drainage ditches onsite for excessive erosion.
- Verifying spill kit to ensure all equipment is in place.

Annual Inspections – Detailed Annual inspections (FSEPC630) are performed on each of the PCS Transformers in accordance with the Operations and Maintenance Manual (See FSEPC630) which include inspections and testing of PCS Transformer equipment to verify proper operation. Specific elements of the annual inspections related to spill prevention and detection include the following:

- Visual Inspection of the physical and mechanical condition of the transformer.
- Visual Inspection of the anchorage, alignment, AND grounding.
- Verification of alarm, control, and trip circuit operation for the temperature and level indicators.
- Verification of correct liquid level in tanks and bushings

Overfill Prevention Systems - All transformers are equipped with direct-read level gauges. The pressure and level of oil in each transformer is monitored continuously via a remote monitoring system with alarms. These alarms are communicated to discharge response personnel via their mobile phones.

6.9 Spill Response Equipment

The following spill response equipment is maintained in a spill response kit and available at the PV Solar Plant at all times:

- 100 Absorbent Pads (Oil, Gas & Diesel)
- 5 18" x 18" Oil Absorbent Pillows
- 10 3" x 4' Absorbent Socks (Oil, Gas & Diesel)
- 1 36" x 36" Neoprene Drain Cover
- 1 1 Lb. Jar of Plug n Dike (Leak Stop)
- 8 HD Hazmat Disposal Bags
- 2 Pairs of Nitrile Gloves
- 1 Spill Instruction Sheet
- 1 Laminated List of Contents

The spill response kit is checked during the Solar Power Plant Monthly Safety Inspection to ensure that the protective seal is intact. If the seal is not intact, the contents of the spill kit are to be inventoried against the proceeding list to ensure all materials are in the kit and the protective seal replaced.



6.10 Spill Response, Control, and Countermeasures

The Power Plant Supervisor is the designated spill response coordinator and is responsible for directing the spill prevention, control, and countermeasures plan requirements and ensuring that proper notifications have been made to all government regulatory bodies and company management personnel.

The Power Plant Supervisor will, on a yearly basis, test the effectiveness of this plan through drills and/or staff training.

Records detailing how company personnel responded will be documented and reviewed with operations personnel.

6.11 General Spill Guidance

Immediate action must be taken to control, contain, and recover discharged product. In general, the following steps are taken:

Only respond if trained to do so;

Evacuate workers from the spill area;

Eliminate potential spark sources;

If possible and safe to do so, identify and shut down source of the discharge to stop the flow;

Contain the discharge with sorbents, berms, fences, trenches, sandbags, or other material;

Restrict access to the spill and surrounding area;

Move materials that may be in the path of the spill;

Contact regulatory authorities and the response organization; and

Collect and dispose of recovered products according to regulation

6.12 Spill Response Procedure

CONTAIN AND NOTIFY

NOTE: A listing of contact and emergency notification phone numbers is listed page 45 of this manual.

1. If the person who identifies the spill is not a trained employee, they should evacuate workers from the spill area and contact the power Plant Supervisor Immediately.
2. If the person is a trained employee, take steps, or initiate procedures to stop, control, and/or contain the spill until assistance arrives, or clean up the spill if possible.
3. The Power Plant Supervisor will classify the spill as level 1 (minor), level 2 (moderate), or level 3 (major) in accordance with section 6.4 of this procedure.
4. As soon as possible (but within 30 minutes), notify the following:
 - Power Plant Supervisor **OR** the Director, Power Plant Operations and Maintenance
 - Enbridge Representative
 - Safety Officer
5. The Power Plant Supervisor will notify the following as soon as possible, when there is a reasonable understanding of the nature and extent of the spill, and within 24 hours:
 - MOE Spills Action Centre at 1-800-268-6060
 - The designated spill cleanup company
6. If the spill has entered a watercourse OR is a level 3 spill, the Power Plant Supervisor will immediately notify the Sarnia Drainage Superintendent at 519-332-0330.

7. If a spill is transported to a property not owned by Enbridge, the Power Plant Supervisor will notify the property owner.

PROTECTION

1. Wear suitable personal protective equipment and clothing before approaching the spill area.
2. For all spills, wear gloves, safety glasses, and flame-retardant clothing (if required). The flame retardant clothing is stored with the on-call site Supervisor.
3. Wear additional personal protective equipment and clothing as dictated by the MSDS or supervising authorities. All MSDS sheets are stored within the Substation work trailer.
4. Assess potential hazards that may be present at the spill or in the spill area (i.e., electrical, mechanical, weather, or other) and take precautions.

STOP, CONTAIN and CLEAN UP

1. Locate the source of the spill or leak.
2. Restrict access to the spill and surrounding area
3. If a spill is present at a PCS Transformer, the on Power Plant Supervisor will determine when the spill should be contained and cleaned-up based on personnel safety.
4. The PCS Transformer will be shut-down prior containment and clean-up.
5. Close, block, stop or plug the source.
6. Place booms and absorbent pads around spill area as required to contain the spill.
7. If possible, attempt to collect the spill in an appropriate container.
8. If possible, construct a dike around the spill, beginning in the direction of any oil product flow.
9. Move materials that may be in the path of the spill.
10. Use rags, damp cloths or absorbent materials for general clean up of liquids.
11. Use brooms or shovels for the general clean up of dry materials.
12. If water or absorbent materials are used, they must be collected and properly disposed of (i.e., shovel used absorbents or spilled materials into clean empty drums, properly label, and arrange for an appropriate licensed waste hauler to remove).

DECONTAMINATE

1. Wash or dispose of any used PPE exposed to the spill.
2. Contain wash waters and dispose of as indicated above.

RESTOCK

1. The Power Plant Supervisor is responsible for ensuring spill supplies are restocked.
2. Return all cleaned reusable equipment to designated locations.

DOCUMENT

1. The Power Plant Supervisor is responsible for initiating and completing the Spill Report (Figure 5 -) within the required time frames.
2. Forward copies of the completed form to the following:
 - A. Director, Operations and Maintenance
 - B. Enbridge Representative
 - C. First Solar Safety Officer
3. If required, the Director, Operations and Maintenance will forward a completed copy of the Spill Report, along with other reporting requirements prescribed in the *Environmental Protection Act*.

**7 EMERGENCY CONTACT INFORMATION****Table 2 Sarnia Site Emergency Contact Information***Physical Address: 1604 Churchill Line, Sarnia, ON N7T 7H3*

PERSON/ ORGANIZATION	CONTACT INFORMATION
Fire Department	519-332-0330 ext. 211 911
Police	519-344-6001 ext. 0 911
Medical Emergency	519-882-3797 ext. 5024, 5021, 5020
HAZMAT	CVECO – 519-332-2010
Safety Officer	Doug Foubister – cell 519-490-5374
Site Manager	Richard D'Amato –cell 519-490-5093
Poison Control	1-800-268-9017
Bluewater Health Hospitals	519-464-4400 89 Norman Street, Sarnia, ON N7T 6S3, Canada
Animal Control	519-332-0330.ext. 351
Director of Power Plant Operations	Telephone: 602-384-9538 Cellular: 602-571-2108
Power Plant Supervisor	Telephone:519-344-2187 Cellular: 519-490-5161
Manager of Maintenance Analysis	Telephone: (602) 384-9506 Cellular: (480) 371-6028
MOE Spills Action Centre	1-800-268-6060
Sarnia Drainage Superintendent	519-332-0330
Other	

**8 SAFETY FORMS AND REPORTS INDEX**

REPORT NUMBER	DESCRIPTION
FS-EHS-R.01	Accident Injury/Near Miss Management Form
FORM NUMBER	DESCRIPTION
Figure 1 -	Accident Injury/Near Miss Management Form
Figure 2 -	First Solar Site EHS Manual Receipt And Acknowledgment
Figure 3 -	Solar Power Plant Monthly Safety Inspections
Figure 4 -	Job Hazards Analysis Worksheet
Figure 5 -	Spill Report
Figure 6 -	Complaint Monitoring/Resolution Form



Figure 1 - Accident Injury/Near Miss Management Form

FIRST SOLAR – _____ PROJECT SITE

Accident Injury/Near Miss Time, Date, & Location Information:					
Accident Injury/Near Miss Date:		Time:			
Location (Building or Area):					
Supervisor Notification Date:		Time:			
FS Supervisor Notification Date:		Time:			
Information on Associate Involved:					
Name:		Job Title:		Time with Job Title:	
Division:		Company Name:		Dept. Number:	
Description of the Accident/Near Miss					
Background Information:					
Summary:					
Near Miss/Non-Injury Investigation Information: (For additional space, use the Additional Information section or see attachment)					
Name of Witnesses:					
What was the employee doing when the incident occurred?					
How did the near miss/non-injury occur?					
Was Personal Protective Equipment required?				YES	NO
If yes, describe:					
Was the required Personal Protective Equipment worn?				YES	NO
If yes, describe:					
If no, why not					
Was an Unsafe Condition Report generated as a result of this accident??				YES	NO
If yes, report number:					



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ROOT CAUSE INVESTIGATION

PROCEDURE	COMMUNICATION	MANAGEMENT SYSTEM	MANAGEMENT SYSTEM
Not available or inconvenient for use	Unclear communication	Policy or control not strict enough	Complex System
Difficult to use	Communication	No standard policy or control	Knowledge-based decision required
Use of the procedure was not required but should be	Standard terminology not used	Confusing/incomplete policy or control	Monitoring > 3 items at once
Followed Incorrectly	Repeat back not used	Conflicting SOPs	Extreme judgment/decision demands
Change in Work found out in the field required a revised approach	Long message	Technical error in the policy or control	Non Fault tolerant system
Excess references in procedure	Noisy environment	Lack of policy or standard Enforcement	Errors not detectable
Details less than adequate	No Communication or Untimely	No way to implement the policy or Standard	Error not recoverable
Sequence wrong	EQUIPMENT	No accountability	HUMAN ENGINEERING
Facts wrong	Design specifications less than adequate	No method of implementing the Policy or standard	Arrangement/placement of Protective covers
Situation not covered	Design not to specifications	Infrequent audits & evaluations	Labels less than adequate
Wrong revision used	Problem not anticipated	Inadequate Supervision	Controls less than adequate
WORK ENVIRONMENT	Independent review less than adequate.	No employee feedback	Monitoring less than adequate
Housekeeping poor	Inadequate evaluation of change	Unclear assignment of responsibilities	TRAINING
Hot/Cold	Not disconnected properly	No reinforcement	Training was not provided
Poor lighting	No PM	Corrective Actions less than adequate or not yet implemented	Did not attend provided training
Noise	PM not being conducted		Did not understand requirements
Cramped quarters	Defective equipment/parts		Refresher training less than adequate

REMEDIAL ACTION

What is being done immediately to prevent this near miss from happening again and who is responsible for the assignment?

What long term actions are planned to prevent this near miss from happening again?

Date for long term action implementation:

Additional Information:

Supervisor's Signature:		*Manager's Signature:	
Employee's Signature:		**Director's Signature:	

*Signature required for Medical Treatment and LOST TIME

** Signature required for LOST TIME



Figure 2 - First Solar Site EHS Manual Receipt and Acknowledgment

I have received a copy of First Solar's Site EHS Manual, and I understand that I am responsible for reading the policies and practices described within it. I understand that this Site EHS Manual replaces any and all prior Site EHS Manuals, policies and practices of the company.

I understand that the policies contained in this Site EHS Manual may be added to, deleted or changed by the Company at any time. I understand that neither this Site EHS Manual nor any other written or verbal communication is intended to, in any way, create a contract of employment.

I Understand I am an Associate-at-will.

If I have any questions regarding the content or interpretation of this manual, I will bring them to the attention of my First Solar Site Manager/Designee.

Name (please Print): _____

Signature: _____

Last 4 digits of SS#: _____ Date: _____



Figure 3 - Solar Power Plant Monthly Safety Inspection Checklist

Inspection Location:			
Date of Inspection:		Time of Inspection:	
Department/Areas Covered:			

	SAT	Unsat	COMMENTS	W/O Number
Ventilation				
<input type="checkbox"/> Fumes	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Vapors	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Dust	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/>		
Site Conditions				
<input type="checkbox"/> Access	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Structure condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Aisles	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Roads	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Work areas	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Housekeeping	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Slopes (erosion)				
<input type="checkbox"/> Ditches/culverts/swales (Erosion or sedimentation)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/>		
Floors, Stairways and Walkways				
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Housekeeping	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Guardrails	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Illumination	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Handrails	<input type="checkbox"/>	<input type="checkbox"/>		
Ladders, Scaffolds, etc.				
<input type="checkbox"/> Suitability	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Properly used	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Strength	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Properly maintained	<input type="checkbox"/>	<input type="checkbox"/>		
Excavations				
<input type="checkbox"/> Shored or sloped	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Access	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Barricaded	<input type="checkbox"/>	<input type="checkbox"/>		



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<input type="checkbox"/> Spoilage piles	<input type="checkbox"/>	<input type="checkbox"/>		
Illumination				
<input type="checkbox"/> Day - Work area	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Night - Work area	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Passageways	<input type="checkbox"/>	<input type="checkbox"/>		
Electrical Equipment				
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Identification of controls	<input type="checkbox"/>	<input type="checkbox"/>		
Transformers				
<input type="checkbox"/> Oil Level OK	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Pressure OK	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> No signs of leakage	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Enclosure - no damage, rust or deterioration	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Bolts, rivets, or seams	<input type="checkbox"/>	<input type="checkbox"/>		
Harmful Materials				
<input type="checkbox"/> Storage	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Handling	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Spill kit supplies	<input type="checkbox"/>	<input type="checkbox"/>		
Personal Protective Equipment				
<input type="checkbox"/> Adequacy	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Availability	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Used	<input type="checkbox"/>	<input type="checkbox"/>		
Machine Guards				
<input type="checkbox"/> Controls accessible	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Lock-out procedures	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Operating procedures	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Controls identified	<input type="checkbox"/>	<input type="checkbox"/>		
Hand Tools				
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Suitability	<input type="checkbox"/>	<input type="checkbox"/>		
Portable Power Tools				
<input type="checkbox"/> Condition	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Suitability	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Grounded	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/> Double insulated	<input type="checkbox"/>	<input type="checkbox"/>		



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Hoisting Equipment

- ☐ Controls layout
- ☐ Safety devices
- ☐ Rigging
- ☐ Records
- ☐ Signals

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Materials Handling Equipment

- ☐ Condition
- ☐ Controls
- ☐ Guards
- ☐ Records

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Material Storage

- ☐ Stability
- ☐ Convenience
- ☐ Housekeeping

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

First Aid

- ☐ Supplies
- ☐ Supplies Condition
- ☐ Qualified attendant
if required

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Fire Prevention

- ☐ Equipment
- ☐ Exits
- ☐ Flammable materials
controlled

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

EHS Program

- ☐ EHS Manual
- ☐ Part II of the *Code*
posted
- ☐ Spill Kit

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Additional Comments:



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Figure 4 - Job Hazards Analysis Worksheet

Job or Activity: _____
Prepared by: _____
Competence/Qualification Required: _____
Approved by: _____

Location: _____
Job Number: _____

HAZARD IDENTIFICATION Identify hazards that may be present by checking items on the list below.

HAZARD	HAZARD	HAZARD	HAZARD
Sharp Materials	Slippery Surfaces	Falling Objects	Cranes or Lifting Equipment
Glass Handling	Trip Hazards	Engulfment	Suspended Loads
Moving Machinery	Tools & Equipment	Difficult to Communicate	Low Voltage Electrical Hazard
Pinch Points	Poor Lighting	Confined Space	High Voltage Electrical Hazard
Cadmium Exposure	Poor Visibility	Difficult Entry/Exit	Overhead electrical lines
Use of Chemicals	Limited Work Space	Oxygen Deficiency	Multiple Electrical Feeds
Flammable Materials	Forklift Traffic/Use	Oxygen Excess	Remote Area
Inhalable Dusts/Fibers	Heat/ Sunlight/ UV Radiation	Toxic Gas Present	Working at Heights
Manual Handling	Ionizing radiation	Potential for Difficult Rescue	Ladders Used in the Task
Ergonomic Stressors	Lasers	Temperature Extremes	Scaffolds
Vibrations	High Noise Levels	Explosive Gas Present	Pressurized Fluids

CONTROLS tick those identified

ADDITIONAL PRECAUTIONS			
Aprons	Goggles	Sleeves	
Barricades	Hard hat	Tyvek	
Electrical Rated Face Shield	Harness	Ventilation	
Electrical Rated Gloves	Hearing Protection	Welding Face Shield	
Erect Scaffolding to Access	High Visibility Vest	Welding screen	
Erect Warning Signs	Lighting	Cut Resistant Gloves	
Fall Arrest Systems	Locks and Tags	Cut Resistant Aprons	
Fire Extinguishers	Portable LEV	Cut Resistant Sleeves	
Fire Rated Clothing	Respirator or Dust mask	Chemical Resistant Gloves	
Full Face Shield	Safety Glasses	Chemical Resistant Aprons	
Gloves	Safety Shoes		

ENVIRONMENTAL HAZARDS – (IMPACTS) tick those identified

Air Emissions	Spills to ground	Other:	
Noise	Soil Erosion	Water	
Waste Water			

PERMITS	
Energized Work	
Excavation	
Confined Space	
Hazardous Work Clearance	
High Voltage Access	
Access to Area	
Hot Work Permit	
Other	

**Figure 5 - Spill Report**

Part A: Spill Information		
Report Completed by:		Date:
Date of Spill:	Time of Spill:	Material Spilled:
Location of Spill:		
Approximate Amount Released:		Extent of Spill (m ²)
Circumstances:		
Weather Conditions:		
Part B: Geographic Details		
Proximity of Fence Line/Property Line:		Topography:
Water Table:		Watercourse, sewer, drain:
Surface (soil, snow, ice, water, concrete, asphalt, etc):		
Immediate Clean-up Actions Taken:		
Part C: Notification		
MOE Spills Action Centre 1-800-268-6060	Person Spoken to:	Time:
Instructions/Response:		
Director, O&M 602-571-2108	Person Spoken to:	Time:
Instructions/Response:		
Enbridge Representative	Person Spoken to:	Time:
Instructions/Response:		
Safety Officer. 519-490-5374	Person Spoken to:	Time:
Instructions/Response:		
Sarnia Drainage Supt. 519-332-0330	Person Spoken to:	Time:
Instructions/Response:		
Spill Cleanup Company	Person Spoken to:	Time:
Instructions/Response:		
Landowner	Person Spoken to:	Time:
Instructions/Response:		

**Figure 6 - Complaint Monitoring/Resolution Form**

Part A: Complaint Information	
Report Completed by:	Date:
Date of Complaint:	Time of Complaint:
Received FROM:	Phone:
Address:	Email:
Contact Type: <input type="checkbox"/> Email <input type="checkbox"/> Face to Face <input type="checkbox"/> Phone <input type="checkbox"/> Other:	
Nature of Complaint:	
Immediate Actions Taken:	
Weather Conditions:	
Noise Related? YES <input type="checkbox"/> NO <input type="checkbox"/> (If yes, notify MOE in writing within 2 days)	
Additional Actions Required? YES <input type="checkbox"/> NO <input type="checkbox"/> (If yes, complete part B)	
Part B: Additional Actions Required	
Recommended Additional Actions:	
Required Completion Date: Date:	
Concurrence: Director, O&M	
Part C: Review and Close Out	
Instructions/Response:	
Actions Completed YES <input type="checkbox"/> NO <input type="checkbox"/>	If no, document resolution below
Resolution:	
Completed by:	Date:
Approval: Director, O&M	Date: